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A SQUARE MEAL—TORTILLAS AND AVOCADO

Tortillas are made from maize or Indian corn which has been treated with lye and ground coarsely upon a stone. Four or five of them and a good sized avocado are looked upon by the average Guatemalan Indian as a good meal. The avocado is eaten without the addition of anything more than a little salt, and a bit of tortilla serves as a spoon. (Frontispiece.)

AVOCADOS AS FOOD IN GUATEMALA

A Fruit of Particular Interest at this Time When Products of Great Food Value Are Receiving Much Attention—Its Importance Among the Guatemalan Indians—Analyses Show High Oil Content

WILSON POPENOE

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NORTH Americans, particularly those who have been watching the development of the avocado industry in California and Florida, are familiar with the statement that the avocado is a fruit of "unusual food value." There is no occasion for disputing such a statement, yet it does, perhaps, need to be interpreted. We recognize the olive as a fruit of "unusual food value," likewise the date. Will the avocado, then, take a place in our national economy comparable to that held at present by either the olive or the date?

While no one can foresee the extent to which the avocado will eventually be used in this country, it is suggestive to examine its status in other countries and its claims upon our favor. The increasing popularity of the avocado in the United States is doubly encouraging when we remember that it has developed upon the use of this fruit as a salad, almost as a luxury. If it is so acceptable to the American palate that it will be purchased at high prices and consumed solely for the gustatory pleasure which it produces, what rôle will it play when it can be obtained so cheaply that it will compare favorably, pound for pound, with other foods as a source of bodily energy and repair?

The American palate is eccentric. It may truthfully be said that it is too eccentric. At the present time we are making the greatest effort in our history to control our eccentricity and eat things for which we have never possessed a predilection or even have enjoyed, because we know them to be good foods and because certain other foods, of which we are more fond, are needed by our armies and by our allies. It has always been difficult to place a new food upon American tables. The mere fact of its being unusual—something to which we have been unaccustomed—is sufficient to make us turn it down, in nine cases out of ten, without even giving it a fair trial. Strange, is it not, how obstinate we are in matters of this sort? We are willing to wear new kinds of clothing—in fact we delight to do it—but many of us will not try new foods.

Yet in spite of this prejudice against foods which we are not used to eating, the avocado has made rapid strides toward popularity. One factor in its favor has been the high price demanded for the fruits. The psychological effect of this cannot be denied. It is difficult for anyone to pay 75 cents for a small portion of avocado salad, and then refuse to eat it. And if he eats it, even though he convinces himself, by an elaborate process of reasoning, that he does not like it, the worst of the battle is over. The avocado is a new taste. It is not a disagreeable taste, it is simply new. Once the palate is accustomed to it, a liking is soon developed, and I have yet to hear of a case where anyone sampled a *good* avocado three times and still maintained that he did not like it.

A DELICIOUS FRUIT

As far as can be judged from the experience of the past ten years, Americans in general are going to like the avocado immensely. Probably not one per cent have tasted it as yet, but among those who have been fortunate enough to do so there is no question regarding the popularity of this fruit. It must be

AN APPETIZING, CHEAP, AND WHOLESOME FOOD

In the small towns of the Guatemalan highlands good avocados are sold at half a cent each, or even less. In the capital itself, where they must be brought from distances of 10 to 50 miles, they are high when the price is more than one cent. At such prices it is doubtful if there is any other food which can compare with the avocado in value. And in addition to being cheap it is a tasty food, and so wholesome that it can be used regularly as one of the major articles of diet. (Fig. 1.)

admitted that the avocado is delicious. It is a taste which grows upon one. The delicately rich flavor of its soft creamy flesh is pleasant and satisfying to a degree rarely experienced. While it is most commonly eaten with the addition of nothing more than a little salt and a dash of vinegar or lemon juice, it blends admirably with certain other foods. In Guatemala, for example, it is the custom to add diced avocado to meat soups at the time of serving, while in Cuba a delicious omelet is made by adding finely diced avocado in the same manner as cheese is used in the North.

Granting that the avocado can be grown successfully in the United States, a statement no longer open to question, what may we expect of it in the future? It is not my purpose to offer prophecies, but to point out by a brief description of conditions in Central America, what the avocado *can* mean to a people who have an abundant supply of the fruit during a large part of the year.

The Maya race, which formerly inhabited the lowlands of southern Mexico, Guatemala, and northern Honduras, is broken up into various tribes now occupying the highlands of Guatemala, extending northward into the lowlands of Yucatan, Tabasco, and Chiapas. Like their ancestors, the Mayas are an agricultural people whose principal crop is maize or Indian corn. They supplement this staple article of diet with squashes, beans, avocados, meat and a few other products.

In certain portions of the Maya territory the avocado is eminently at home. It not only grows in almost every dooryard, but also in the edges of cultivated fields and along the roadsides, yielding generously of its handsome fruit, although it receives no care from man. This is particularly true in those sections of the Guatemalan highlands which are occupied by the Cakchikel, Kiché and Kekchi tribes. The long ripening season makes it possible to eat avocados during eight months of the year; their abundance results in their being so cheap that only the best varieties have any monetary value at all, inferior ones, such as small fruits with very large seeds, not bringing enough to pay for carrying them to market. The best fruits, when offered for sale in the little Indian villages tucked away in the Guatemalan mountains, may realize as much as two *reales* each—the equivalent of about half a cent. Ordinary fruits seldom bring more than a *real*.

Here, then, is an interesting state of affairs: avocados in abundance, and at prices which place them within the reach of the poorest villager. If avocados are ever to assume an important place in the dietary of any people, we would say, they should certainly do so here.

PRACTICALLY REPLACES MEAT

It is difficult for one who has not actually visited these regions to appreciate the extent to which the avocado replaces meat in the dietary of these industrious folk. It must be understood that meat, in Guatemala, is a luxury to be indulged in mainly by the well-to-do, its use among the poorer classes being very limited.

Let me illustrate the Guatemalan's attitude toward the avocado by a few incidents which came under my observation. My assistant on numerous collecting trips among the Guatemalan mountains was a full-blooded Kekchi Indian, José Cabnal of Cobán. In telling me of the customs of his people he touched upon the question of food. "Four or five tortillas," said he, "a good sized avocado, and a cup of coffee—this we look upon as a good meal." The tortilla, as is well known to many Americans, is nothing more than a thin cake made from maize, which has been treated with lye and ground coarsely on a stone.

Later, while stopping one noon in the village of Panajachél, high up in the mountains on the border of Lake Atitlán, I chanced to step out into the central plaza or square, where there were a number of Indian *cargadores* en route from Sololá to Guatemala City with loads of pottery on their backs. They had stopped for their noonday meal, and as I approached them I saw that each one had half an avocado in one hand, which he ate with

MAXIMUM DEVELOPMENT OF THE AVOCADO TREE

Such trees as this, probably a century or more in age, are rare in Guatemala, but serve admirably to illustrate the habit as well as the maximum development of the avocado. Only on good heavy soils can such dimensions be attained. A mature tree will sometimes bear as many as two thousand medium sized fruits, or a thousand large ones. (Fig. 2.)

a bit of tortilla held in the other. Maize and avocados. Apparently this is a diet which the Indian finds sustaining under the most severe physical exertion, for there is no harder work than that of the cargador, who frequently carries a hundred and fifty pounds on his back, and thinks nothing of making a journey of a hundred miles in five or six days. And he likes this diet so well that he makes no effort to improve it, even by seasoning his avocados, although salt is sometimes used. When he has no tortilla to use as a spoon, he will scoop out the avocado pulp with his right index finger.

While staying in Guatemala City, I often found it necessary to purchase large quantities of avocados in order to obtain the seeds. These fruits we piled in a corner of the patio, covering them with straw to hasten ripening. Every few days it was necessary to go over the pile and pick out the ripe fruits. The seeds were then removed, and the halved fruits thrown to one side. Before we had progressed far with this work, José inquired what we were going to do with the pulp. I replied that he could dispose of it as he chose, whereupon he notified all the neighbors, and thenceforth there was a constant procession of natives coming in through our gate with baskets or boxes on their heads, and going out with loads of avocado pulp. This they took to their homes, and as long as it lasted they needed no other food except the ubiquitous tortilla.

It must be admitted that the tortilla is a highly sustaining article of diet, even though it may be, as Charles Macomb Flandrau happily puts it, a melancholy form of nourishment. But I do not recall having met a Guatemalan who would voluntarily choose to make a meal on tortillas alone, while I do recall having seen many who seemed quite content with tortillas and avocados.

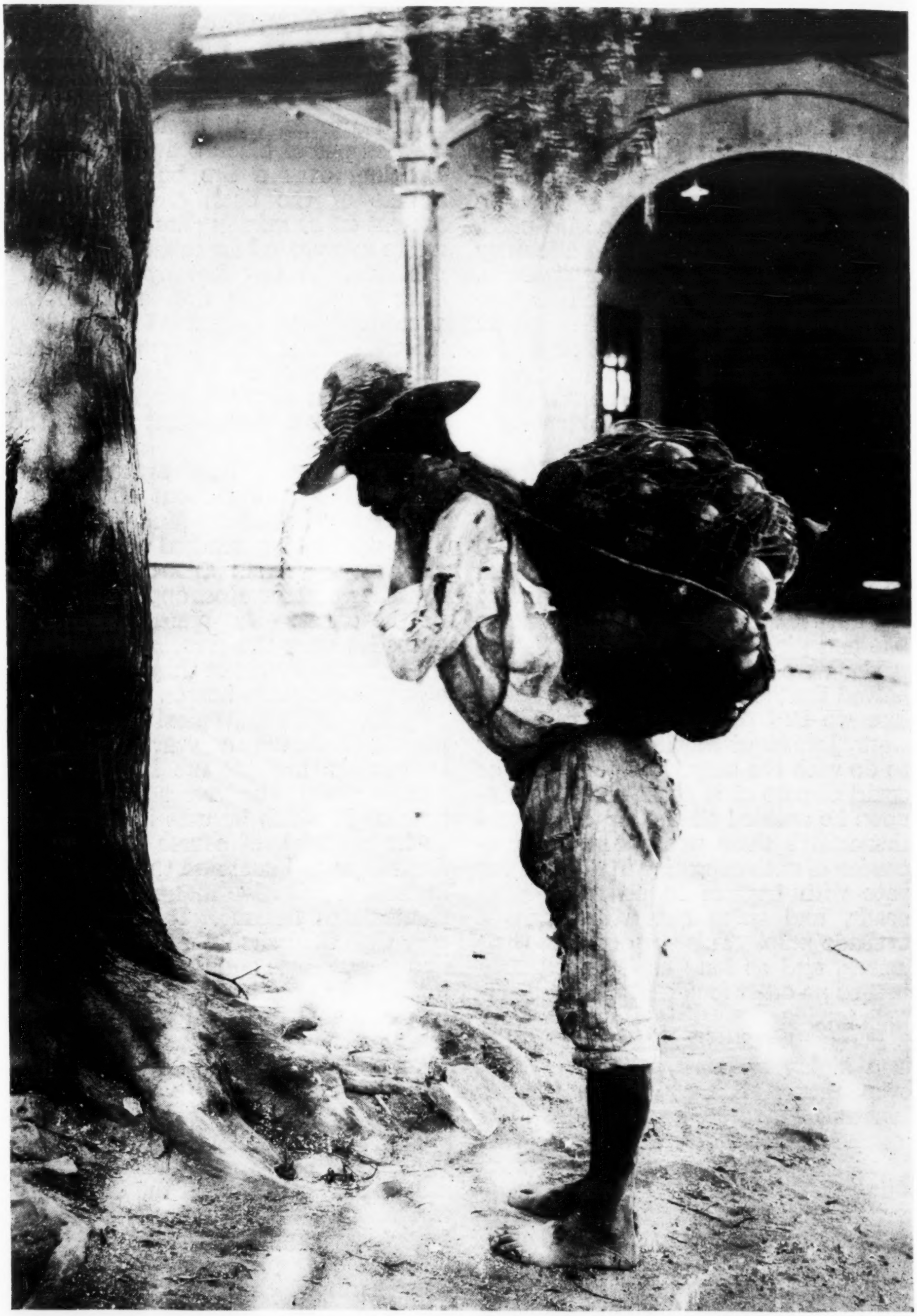
Walking through the streeets of Purulá, a village in northern Guatemala, I chanced to see a fine avocado tree standing behind the hut of an Indian family. I entered the yard to make inquiries, and was invited into the house to inspect some of the fruits. It was a typical Indian hut, mud floor, thatched roof, and sides made of poles lashed together with lianas. A smoke-covered pot of black beans was slowly bubbling over a fire burning in the middle of the floor, and the omnipresent *ká* or grinding stone, on which maize is prepared for tortillas, stood to one side. A few feet overhead, and directly above the fire, a basket of avocados was suspended from the rafters. Their presence over the fire may be explained by the statement that it is a common practice to put avocados in a warm place during the ripening process.

Maize, beans, and avocados. A glance around the room showed no other foodstuffs of any kind. Probably meat would be purchased occasionally, and a savory stew in which chile peppers, squashes, and tomatoes appeared, would be the result. But maize, beans and avocados were the principal staples in this household, just as they are in many other Guatemalan homes.

These incidents, typical of many experienced during a year's travel in Guatemala, indicate the Indian's attitude toward the avocado and the manner in which he uses it. It is not to be assumed, of course, that North Americans will consume their avocados in such a primitive manner as do the Guatemalan Indians. It is not necessary that they should do so. The fats and the proteins and the carbohydrates locked up in the fruit are just as available to those who eat a delicate avocado salad as they are to the aborigine who takes the unseasoned pulp with a scrap of tortilla.

CONSTITUENTS OF THE AVOCADO

Thanks to the investigations of such men as Professor Jaffa of the University of California, we are gradually acquiring knowledge regarding the various constituents of the avocado, and the proportions in which they occur. An interesting table published by Jaffa in Bulletin 254 of the Agricultural Experiment Station at Berkeley shows that, as a result of 28 analyses, including about 24 varieties, water was present in the pulp or edible portion of the fruit in



STARTING TO MARKET WITH A LOAD OF AVOCADOS

Throughout the Guatemalan highlands there is an avocado tree in nearly every dooryard. From some regions, such as Antigua, where the trees are particularly abundant, large quantities of the fruit are carried to the markets of Guatemala City, at least a day's journey across the mountains. Indians who are trained for this work can carry a hundred and fifty pounds without difficulty. (Fig. 3.)

percentages varying from approximately 60 to 80, with an average of 70. Protein was present in amounts varying from 1.30% to 3.70%, with an average of 2.08%. The percentage of fat varied from about 10 to 30, with an average of 20.1. Carbohydrates were present in varying quantities, the lowest analysis showing 3.69% and the highest 16.17%, while the average was 7.39%. Finally, the amount of ash varied from 0.60% to 1.93%, with an average of 1.26%.

As pointed out by Professor Jaffa in his explanation of these analyses, the total dry matter in the edible portion of the fruit is greater in the avocado than in any other fresh fruit, the nearest approach being in the case of the banana, which contains about 25%. The protein content is also high for a fresh fruit, approaching closely that of some of the dried fruits in common use. In Professor Jaffa's own words, "so far as protein and ash in fresh fruits are concerned, the avocado stands at the head of the list, and, with reference to carbohydrates, contains on an average fully 50% of that found in many other fresh fruits. These facts alone would warrant due consideration being given to the value of the avocado as a fresh fruit. The chief value of the avocado as food, however, is due to its high content of fat. This varies, as shown by the analyses, from a minimum of 9.8% to a maximum of 29.1%, with an average of 20.1%."

As to the caloric or energy-producing value of the avocado, one pound of the pulp represents about 1,000 calories, on an average, the maximum and minimum being 1,325 and 597 respectively. The maximum "corresponds to about 75% of the fuel value of the cereals and is not far from twice that noted for average lean meat."

Summing up his remarks to the meeting of the California Avocado Association in October, 1915, Professor Jaffa said: "It would appear that the avocado may be said to be, as far as fruits are concerned, in a class by itself, containing on the average a far higher caloric value than any other fresh fruit except the olive, and in view of the fact that it ranks higher in fat or oil than the average or commonly used olive, it outranks even this fruit with respect to its total food value."

It may be interesting, just at this point, to append a brief table comparing the caloric or fuel value of the avocado with that of a few other foods. For this purpose an average variety should be taken, *i. e.*, one in which there are approximately 1,000 calories to a pound of pulp. In considering the table it must be remembered, therefore, that the position of the avocado would be changed were a variety having a high caloric value chosen in place of an average one.[1]

	Calories
100 grams (about 3½ ounces) boiled rice	322
100 grams white bread	246
100 grams avocado	218
100 grams egg	166
100 grams lean beef	100

It must not be assumed from this table that the avocado has a total food value greater than that of lean beef. It is only the caloric values which are shown, and much of the value of meat as a food lies not in the energy which it produces, but in its ability to build up and repair the tissues of the body.

INTERESTING POSSIBILITIES IN OIL

The presence of such a large percentage of oil in the avocado has suggested that this fruit might yield a table or cooking oil which would be as valuable as olive oil, peanut oil, and other products of this nature. The lack of material in this country for experimental purposes has retarded investigation of the subject, but it has been found by the Bureau of Chemistry that a thick white fat can be extracted by hydogenation which strongly resembles some of the cooking fats now on the American market, and A. C. Hagemann, of New York, in experimenting with avocados of the Mexican race grown at Miami,

[1] The values given in this table, with the exception of that for the avocado, are adapted from Hutchison's *Food and Dietetics*, 4th ed., 1917, p. 426.

A CENTRAL AMERICAN CONTRIBUTION TO THE WORLD'S FOOD SUPPLY

The small tree, whose trunk is seen in the photograph, produced over a hundred 1-pound fruits in a single crop. When it is realized that each of these fruits contains as much nourishment as a small loaf of bread, the enormous value of the avocado as a source of human food is readily appreciated. (Fig. 4.)

Florida, was able to extract a green oil very much like olive oil in character. While of bland, pleasant flavor, it possessed a slightly bitter after-taste which was somewhat disagreeable. Further experimentation would probably lead to the discovery of a method of removing this quality.

It will doubtless be many years before there will be a large enough supply of avocados in the United States to permit of their use for the extraction of oil, yet the subject is one which must eventually receive much attention. It is possible that the large quantities of avocados annually produced in the American tropics might be utilized in the near future for this purpose.

A comparison of the possibilities of the avocado with the olive as an oil producer is suggestive and striking. According to Professor Bioletti of the University of California (writing in Bailey's Standard Cyclopedia of Horticulture), olives in California produce from one-half ton to over four tons of fruit per acre. In France, 2.7 tons is considered a maximum yield, and good orchards are not expected to yield more than 1.3 tons. One ton of olives is calculated to yield about 35 gallons of oil. The production of oil per acre, therefore, varies in California from a minimum of 18 gallons to a maximum of 140. The average is said to be about 50 gallons.

In Florida, an orchard of Trapp avocados at five years of age has produced an average of four crates of fruit per tree. Since there are 80 trees planted to the acre, this gives 320 crates of fruit per acre. Each crate contains an average of 40 avocados which weigh about 12 ounces each; in other words, a crate contains 30 pounds of fruit. One acre therefore produces 320 times 30 or 9,600 pounds of fruit.

In the analysis of the Trapp variety made by Professor Jaffa the edible portion or pulp was found to constitute 71.5% of the entire fruit. The 9,600 pounds of fruit obtained from an acre would therefore furnish 6,864 pounds of pulp. The same analysis shows the percentage of oil in the Trapp variety to be 9.80. The entire amount of oil in this 6,864 pounds of pulp is therefore 672 pounds. Calculating roughly that there would be 7 pounds of oil to the gallon, this would make 96 gallons of oil. We are assuming, however, that *all* of the oil is saved, whereas Bioletti states that only 50 to 65% of the oil contained in the olive is recovered by the process of extraction practiced in California at the present day. Naturally, since avocado oil has not been extracted commercially up to the present time, it is impossible to say what percentage will be lost. Hagemann, in his limited experiments, found that 18.5% of the entire weight of the pulp was extracted as oil. It is unlikely that the pulp originally contained more than 30% of oil, and it probably contained considerably less. But calculating that the maximum amount quoted for olives, 50%, will be lost in extraction, we still have 48 gallons of oil, which is practically the same as the average obtained from the olive in California today.

With every allowance for loss in extraction, then, an acre of Trapp avocados would yield as much oil as an average acre of olives in California. Recalling that the percentage of oil in the Trapp is not quite 10, while in some other varieties it is as high as 30, the possibility of getting more oil from the avocado than from the olive becomes apparent at once. The whole subject is new, of course, and the calculations just given, while based on actual figures obtained in Florida avocado groves and in laboratory analyses of the fruit, cannot be considered as anything more than suggestive of the possibilities of this interesting fruit along one very important line, the production of oil.

THE NASSAU SURVEY

**Study of Mental Disorder and Social Maladjustment in a Typical Community—
Small Part of the Population Makes Most of the Trouble—
Institutional Care Would be an Economy.**

IN EVERY community there are a certain number of people who do not fit into the social organization. They cannot earn a living, or they cannot keep the peace, or they cannot stay sober, or for some similar reason they earn the right to be labeled "cases of social maladjustment" by the man of science.

How many such cases are there in a typical American community, and to what extent is their maladjustment to be attributed to mental disorders?

Many communities have attempted to answer these questions, but no attempt has been more painstaking than that of the "Nassau Survey," which examined a representative county of Long Island last summer. The report of this survey was prepared by the director, Dr. Aaron J. Rosanoff, and is published by the National Committee for Mental Hygiene.[1]

The survey itself, as readers of the JOURNAL OF HEREDITY will recall, was the outgrowth of the work of the Nassau County Association, whose committee on Health and Eugenics undertook, as long ago as 1913, to ascertain what families in the community were supplying mental defectives to the population. In the final and ambitious project carried out last summer, many agencies coöperated: The National Committee for Mental Hygiene, the Rockefeller Foundation, the United States Public Health Service, the Eugenics Record Office, and various New York state organizations and institutions.

Nassau county was considered particularly worth while surveying because "it would be difficult to find anywhere another county which is not too large or too populous and which, at the same time, as fully represents the widely varied features of American life." "It has many families descended from Colonial and Revolutionary stock; it has an ample representation of newer immigrant stocks, especially Slavonic and Italian; and it has a considerable colored population."

INSTANCES OF MALADJUSTMENT SOUGHT

The question which the survey set out to answer was not, as it might have been a few years ago. "What is the percentage of 'insane' or 'feeble-minded' or 'mentally defective' persons in the community;" but rather 'What instances of social maladjustment, sufficiently marked to have become the concern of public authorities, are, upon investigation, to be attributed mainly or in large measure to mental disorders?" Some abnormal cases without social maladjustment were naturally brought to light as a by-product of the work. Says Dr. Rosanoff:

"Wherever the abnormality could be established beyond question by medical diagnosis, in spite of the absence of social maladjustment, the case was included in the enumeration. It is significant that over 10% of the abnormal cases found by us showed no social maladjustment; and even more significant is the consideration that had it been our deliberate purpose to bring such cases to light, the percentage would undoubtedly have been much higher."

From the eugenic point of view, however, such a consideration does not seem to the reviewer to be beyond

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[1] Survey of Mental Disorders in Nassau County, New York, July-October, 1916. Report prepared by Dr. Aaron J. Rosanoff (director of the Survey). Pp. 125, price 25 cents. The National Committee for Mental Hygiene, Inc., publication No. 9; 50 Union Square, New York, 1917.

criticism. It may be easy to find a feeble-minded man, for instance, who has never given any trouble to the police or county authorities; but what will his children be? To take the behavior of an individual as the most important criterion of his social worth may frequently lead to dangerous results.

In a brief review it is not possible to do justice to the abundant data contained in the 125 pages of Dr. Rosanoff's report. Only the more salient conclusions can be suggested.

In the course of the survey 1,592 mentally abnormal cases were brought to light—a percentage of 1.72 for the county. This is recognized as being below the true figures. There was an excess of Negroes among these; but apart from them the native-born whites contributed relatively more defectives than the foreign-born.

"It is probable," Dr. Rosanoff explains, "that wherever in this country old settled communities live in a rural or semi-rural environment, as in Nassau county, conditions prevail which tend to result in the segregation of certain contrasted mental traits in branches in each family; many of the more able and enterprising members of families are attracted to the cultural and industrial centers, failing to find full scope of opportunity in local affairs; those who remain behind thus include a larger proportion of the mentally inferior than is characteristic of the family as a whole; in the course of generations the contrast is further accentuated by the intermarriage of more or less inferior members of different branches of the same family, or by the union of members of equally inferior branches of unrelated families, on the general principle of like mating with like. Thus there are probably many American families consisting, like the now famous 'Kallikak' family, of 'good' and 'bad' branches; and among the most defective old native families discovered in the course of the survey are some bearing names which are also borne by others noted for culture and achievement."

An important finding is that the abnormal part of the population shows a greater tendency to remain single or to divorce and separate. It appears to Dr. Rosanoff that there is no ground for apprehension of any increase of mental disorders, so far as the birth rate is concerned. But there are abundant figures which point in the opposite direction, and few eugenists will venture to give Dr. Rosanoff's finding in this respect a widespread application at present.

To study the influence of heredity was not a primary part of the plan; yet the material furnishes, in Dr. Rosanoff's opinion, "an addition to the already ample evidence showing that in the causation of mental disorders heredity appears as a highly important factor."

Of the 1,592 abnormal cases found, 41.6% are or have been in institutions. It is judged that 59.4% require temporary or permanent institutional treatment; 29.5% require other treatment (private custody, medical care, etc.); and 12.1% require no treatment. Many of the persons in custody are in institutions wholly unsuited to their needs.

It would seem conservative on the part of the state in Dr. Rosanoff's opinion to double its institutional provisions on the strength of this finding without the slightest danger of such increased provision ever proving to be in excess of the needs.

"The types of institution for which there is particularly urgent need are: (1) schools and colonies for the feebleminded; (2) separate institutions for defective delinquents with provision for classification by sex, age, and perhaps susceptibility to reform; (3) industrial colonies for inebriates, vagrants, etc.; either separate institutions for epileptics or special wards for them in state hospitals or in schools or colonies for the feebleminded."

The inadequate attention paid to mental differences in children as well as adults is commented upon; more special classes are said to be required.

PROPOSED REGISTRATION EXPLAINED

"The registration of mental disorders has been many times proposed, but no effective and practical method of pro-

cedure has been offered. Our experience has led us to feel that, for guidance in this enterprise of registration, the best case is to be made out for the sociological principle. The mind is nothing but an instrument of adjustment of the organism to its environment; and for practical purposes it would seem necessary but to take cognizance of instances of maladjustment sufficiently marked to come to the notice of public officials, charitable organizations, and physicians.

"More specifically, the register in each state may include:

"1. Cases admitted to hospitals for the insane, public or private.

"2. Cases admitted to institutions for inebriates, epileptics and the feeble-minded.

"3. Cases convicted of any crime, exclusive of violations of local laws and ordinances.

"4. Cases coming to light in suits for separation or divorce.

"5. Cases admitted to almshouses.

"6. Cases applying for outdoor relief to overseers of the poor or private charitable organizations.

"7. Some provision for the registration of data pointing to possible abnormality in children in public elementary schools, orphanages, etc.

"8. Mental cases coming to the notice of physicians in private practice.

"Each individual thus registered should receive an identification number; and future instances of mal-adjustment reported in his case should be added to his record and not registered as new cases.

"The first registration, it need hardly be said, would by no means imply in all cases a judgment of mental abnormality. It is obvious, on the contrary, that a register containing all such cases will include many quite normal individuals. The object of compiling a register in the manner here proposed would be to make sure of including all cases of marked mal-adjustment and yet avoid a premature judgment as between normality and abnormality.

"Judging from the results of this survey, it may be anticipated that after several years development such a register will show that the bulk of all crime, vice, dependency and other maladjustments in a given commonwealth is attributable to a comparatively small fraction of the population. Naturally, problems presented by such evils could be attacked more successfully with the aid of material that would be available in such a register than without it.

"The relationship between mental disorders and dependency deserves special consideration owing to its bearing on the question of state provision such as is here advocated. It was shown that of 1,592 mentally abnormal cases 473 were characterized by dependency either as a primary or secondary manifestation; but this number does not include cases found in state hospitals, correctional, penal and other institutions. It is safe to say that at least two-thirds of all the abnormal cases are partly or completely dependent.

GREATER APPROPRIATIONS NECESSARY

"Legislatures throughout the country seem to be loth to make appropriations for the construction of more housing facilities, being disinclined to assume for the state the burden of caring for such large numbers of mental defectives. We have shown, however, that mental defectives are, for the most part, already dependent; in other words, they neither starve nor go without raiment or shelter, but are maintained at the expense of others, receiving support from overseers of the poor, charitable organizations, neighbors, friends, relatives, or from strangers by begging.

"The cost of maintenance of such cases in public institutions is annually between $150 and $200 per capita. This is accomplished through economies rendered possible only by an institutional organization. It is not possible for dependents living at large to be maintained, by whatever means may be available, at such low cost. What their maintenance actually costs under such conditions no one knows; but whatever it is, it is usually not taken into consideration because it does not appear in legislative budgets in large lump sums. Yet the fact is that institutional provision for such cases is not an added expense to

commonwealths, but is a better organized, more economical way of bearing an already existing financial burden, and a more equitable distribution of it.

"The losses that result from spreading venereal infection, from theft, from incendiarism and other anti-social tendencies of mental defectives should also be included in the reckoning; and, from the standpoint of future generations, their unrestrained propagation, when at large, both in and out of wedlock."

Infant Welfare Work in War Time

Now that the United States has entered the war, it is evident that difficulties will be encountered in this country similar to those which have been met in the nations already at war. Although conditions in other countries are different in many respects from those in this country, a study of foreign material will discover many general tendencies for good which can be imitated and other tendencies which should be avoided. Most noticeable in every warring country has been the fact that protection of infancy and maternity has greatly increased in every instance, and the preventive rather than the palliative side has been followed in almost every case by the governments in establishing infant welfare stations, maternity clinics and similar institutions, says Grace L. Meigs in *American Journal of Diseases of Children*, August, 1917.

The work done in England is especiaily interesting. The same urgency has not been felt there as in France because of a higher natural birth rate. Just before the war Parliament was considering making a grant to aid sanitary authorities and the war has had the effect of directing greatly increased attention. The employment of pregnant women and nursing mothers is one of the most vital problems and undoubtedly has a great influence on the infant mortality rate. In Scotland about the same measures have been carried out as in England.

In Germany, our knowledge of conditions is far less complete, but the same lines seem to be followed out as have been found necessary and advantageous in other nations. France has decided upon four measures. These are:

1. The military allowance given to the mother of the children of soldiers whether legitimate or illegitimate.
2. The government maternity grant, which was established by the act of June 13, 1913.
3. The grant given by the government to large families.
4. The help distributed by the *Assistance publique* and by the maternity hospitals, whose object is to enable the mother to care for her baby herself.

The importance of protecting pregnant women and nursing mothers in factories is also recognized, but it is thought that not more than 4% of women so employed belong in these two classes.

Belgium seems to have been able to decrease the infant mortality rate except in Mons. The work in Italy and Russia is not well enough known to permit definite statements regarding conditions there. In New Zealand and Canada, there is not much evidence that much effort has been made along preventive lines, but there is evidence that the work has suffered from the loss of physicians and nurses called to service. The situation there is somewhat analagous to that in the United States, since both are far removed from the scene of conflict.

To sum up the matter it seems that no hasty conclusions should be drawn as to what is immediately necessary in this country; that the chief preventive measure for protecting babies is to insure their care and nursing by healthy mothers in their own homes; and that preventive work should be made the central effort.

GARDENS FOR PLANT BREEDERS

Requirements Necessary for Encouragement of Plant Breeding Heretofore Misunderstood—Environment Usually Not Suitable for Really Constructive Work—Breeder Should be in Close Touch with His Plants

DAVID FAIRCHILD

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WHY cannot we realize the conditions necessary for the encouragement of plant breeding and go ahead and create them? Seen from a perspective which reaches back to the establishment of the experiment stations in this country, it appears to me that we have misunderstood these requirements. The environment of the State Experiment Station is as far as possible from what could be considered ideal for the plant breeder, and I am confident that one reason why, today, with all that has been published about plant breeding, we have so amazingly few practical breeders is because we have misunderstood the requirements of a plant breeder.

The laboratory in a big station building which may have the name "Plant Breeding" on the door is not a place where plant breeding is done. It is a place where the subject is discussed and the laws of heredity are disputed and new principles are worked out, but it is not the place of origin of new varieties of practical importance to the human race. Why should we not recognize in the equipment of the plant breeding laboratory that plant breeding is an early morning occupation, and that the materials with which the breeder deals are of the most fleeting nature—that, like the appearance and disappearance of a comet in the sky, the simultaneous flowering side by side of two plant species is often the event of a plant breeder's life time, and that, unless he is on hand and fully prepared to make immediately a host of crosses, only one of which perhaps succeeds, he never gets another chance at it, and years pass, in all likelihood, before another breeder succeeds in getting the plants in bloom together. In the hybridizing of trees and shrubs, this is peculiarly true. The making of crosses is a very different kind of work from that of the investigator of alcoholic specimens or the microscopic studies of lower plant life.

FORCED FROM PRACTICAL FIELD

As I look over the field, it would seem as though the plant breeders who, under the right environment, would have produced new plants of the greatest value, have been forced by the difficulties which surrounded them, to enter those statistical and microscopic phases of plant breeding which can be done in the indoor laboratories, equipped with microscopes and slide rules. I am not in the least discounting the value of this work, but it does seem as though, by the expenditure of a small amount of money, we might make what would appear to be the most attractive places imaginable for men with a real fondness for plants—places from which would be coming year after year new hybrids and selections of the greatest value to the horticulture and agriculture of the world.

It has been my good fortune to be associated in a helpful capacity with several plant breeders in this country, and, as I look over their surroundings, it seems to me that they have one thing in common. They live among their plants—not a mile or two away from them.

I remember the remarkable place of C. P. Gillett, which he called the Barren Hill Nursery, and which he had transformed into a little paradise of fascinating plants at Nevada City, Cal. I

HYBRID CHINQUAPIN CHESTNUT LOADED WITH BURRS

It is about fifteen years ago that Dr. Van Fleet fertilized in his home place at Little Silver, N. J., the chestnut flowers with pollen from the chinquapin which gave rise to this hybrid plant and through these years its originator has seen and studied the offspring of the first cross dozens of times in the early mornings when no executive activities or "pressing engagements" disturbed his thoughts. (Fig. 5.)

A CORNER OF VAN FLEET'S PLANT BREEDING GARDEN

A miniature greenhouse, a tool and storage shed in which seed is threshed out with a flail or small mill and a lath shed under which tender seedlings and cuttings are protected from the sun, constitute the main equipment of the garden (Fig. 6).

once visited that great plant enthusiast John Rock, of Niles, Cal., and found his little office in the midst of a big nursery. I visited last winter the remarkable place of Doctor Nehrling, near Gotha, Florida, where those wonderful variegated Caladiums originate, and where hosts of other new plants are growing and being studied. There is that wonderful place of Chas. T. Simpson, at Little River, Fla., where, although little breeding is being done, thousands of new plants are being tested. The Marquis wheat, I was told by an old friend of the late Doctor Saunders, of Ottawa, originated in the Doctor's little garden quite near his house, One of the most fascinating places in all Canada I found to be the home of Mr. A. P. Stevenson, of Morden, where the Russian apples first succeeded and showed their possibilities for Canada.

Mr. T. A. Sharpe's place at Salmon Arm, B. C., has the fascination of an intimate plant breeding station.

The small branch station at Talent, Oregon, with its twenty acres of pears, is an ideal place, and it is in the quiet mornings in that charming little nursery that Doctor Reimer has discovered the blight resistance of the Chinese pear species, *P. ussuriensis* and *P. Calleryana*. Edward Simmonds, in our Plant Introduction Garden at Miami, working in the still mornings there, has produced remarkable hybrid annonas and selected and improved papayas. The striking work in the improvement of the Egyptian cotton which has made possible the extensive development of this crop in the Imperial Valley was done by Kearney, Cook and others in a little temporary field laboratory at Somerton, Arizona. Dr. Byron D. Halsted, of New Jersey, with whom I was associated for years, has been hampered always, it has seemed to me, by the fact that his plants and his laboratories were, until recent years, far apart, and he had to drag his specimens back and forth, and it

IDEAL SURROUNDINGS FOR THE PLANT BREEDER.

Dr. Walter Van Fleet standing beside his selected chestnut trees in his little plant breeding garden near Bell, Maryland. Eight acres of land are all he cultivates and he is able because he lives within a stone's throw of it to be among his plants when they are in flower before sunrise and before the bees have visited the blooms. (Fig. 7.)

required an expedition to get to his garden by daybreak. What charmed me when I first knew Luther Burbank was the fact that he had around his doorstep and in his backyard the plants he was breeding, and, that, weak physically as he was, he could work among his plants in the early morning before the people who came to see him were up. This was before the factory and publication bureau built a building and thoroughly commercialized his work. I wonder if he does not often look back to the quiet pleasure of those mornings.

OBSTACLES TO PLANT BREEDING

Sometimes it seems as though everything were against the plant breeder—every tendency in modern times. The commercial emoluments are few, for as soon as he tries to commercialize his new hybrid, he is obliged to develop a selling organization and has to step into quite another world—that of glowing exaggeration and the trials of employing many people, both of them activities which crowd out the time for concentration which the breeder requires, and, as they come in the spring, often interfere seriously with his breeding work. The result is he is generally tied up with some other organization, which, because of expense involved, gives him a room in a big building and a corner of some field used for other purposes; or, and this is even worse, he is put in charge of a botanic garden and a lot of professional gardeners, or an office full of busy clerks who insist on being directed, or a classroom full of boys who are interested in anything but plants and who delight in worrying the professor. The breeding work is a side issue, in any case—the teaching or directing or advising is what he is paid for. Yet how little the real breeder needs! A few acres of land, a skilled devoted man to help him, a little greenhouse and a place in the middle of his acres, where he can live and where he can quietly watch and get ready for the great occasion—the mating of two par-

ONE OF VAN FLEET'S CLUSTERED CHINQUAPIN HYBRIDS.

Produced by a cross made by Dr. Van Fleet on his home place at Little Silver, N. J.; an example of the fact that the plant breeder wants his plants growing close beside his house. (Fig. 8.)

ents, the offspring of which is to be propagated by buds or cuttings and later cover whole hillsides with superb fruit trees or by seed like the Marquis wheat and stretch away to the horizon—one level plain of perfect wheat heads.

I stood under a flowering spray of the Van Fleet rose last summer, and the president of the Rose Society said to me, "I am propagating a million plants of Van Fleet's roses this year. Van Fleet has produced some of the greatest climbing roses of this country."

It was my thought in writing this article that the readers of the Journal of Heredity might like to know that Doctor Van Fleet, the recognized breeder of roses has gathered a practical working collection of plants around him and in six years built up a place which should be an inspiration to any breeder and which illustrates what I am advocating, the establishment of such places by public agencies, wherever the individual plant enthusiast can be found who will utilize them and make them effective.

The Office of Foreign Seed and Plant Introduction can furnish the plants, the breeder can furnish the land, the government should provide the greenhouse and the labor and propagate and distribute the resulting hybrids to the commercial nurseries and proven cultivators of the country.

EARLIEST MAN[1]

A Speculation, Based on Achievements of Lower Animals as to How the Human Race May Have Made its Start—Importance of the Reproductive Instinct as a Source of all Progress—Fire Probably a Late Acquisition.

REVIEW OF A BOOK BY F. W. H. MIGEOD

WHAT were the habits of the earliest of our ancestors who can be called human? The question has often been answered by guesswork, but F. W. H. Migeod thinks it is possible to come a little closer to the facts, by considering what the lower animals do in a given situation, and then assuming that man's ancestors probably did somewhat the same. Mr. Migeod's little book is speculation, but it is interesting speculation, and much of it plausible.

The first step which set off from the bulk of the apes that line which afterward became man, Mr. Migeod ascribes to hybridization. This he believes would provide the new group with physical features which differed considerably from those of its parents, and also give it the chance to have more acquired intelligence than any other single species, since it would, to some extent, learn the acquired habits of both parental species.

Such a hypothetical form the author calls Pre-pithecanthropus. He supposes that by some cataclysm a part of this group was forced to leave its ancestral home and live under entirely novel conditions which afforded stimulus for mental development, as far as the brain of pre-pithecanthropus had any innate possibilities of development. "In the unfamiliarity of his surroundings fear strikes him everywhere, and all his wits are exercised in seeking safety from the real or imaginary dangers which beset him.

"Let us visualize this.

"Pre-pithecanthropus, unable to take refuge in trees (he is imagined to have been forced out of the forest by some geological change), hides in a cleft in the rocks. His mate and offspring crouch inside as far as they can crawl. In his terror at an attack by some carnivorous beast, he flings around his arms, clawing at everything within reach. A stone detaches itself in his grasp, and flies away from his swinging arms. An accidental hit, and his carnivorous pursuer turns and flees. The whole family are saved. Pre-pithecanthropus has done something he had never done before, and never thought of. It does not impress itself upon his brain, however, till he is hunted again, and then he learns to seek better hiding places, and that loose stones have a use.[2]

"It is in the defense of his offspring, therefore, that this creature, new in the world, began to develop his mental faculties. His cares in this respect were constant and prolonged, for with him his young were not cast off in a few weeks, or even months, to look after themselves. It was a case of years, or practically a lifetime, for the female would bear again before the previous progeny had reached maturity, and there would be not one but several offspring requiring the parental care. There was, therefore, a steady and uniform strain on the minds of both parents, but perhaps on the father more than the mother, as the latter would soon again be exercising all her maternal care on the succeeding progeny.

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[1] Earliest Man, by Frederick William Hugh Migeod, F.R.A.I., etc., pp. 133. London, Kegan Paul, Trench, Trübner & Co., Ltd., 1916. "The book was written in the Gold Coast Colony, mostly while the author was living in a Bush station or traveling."

[2] In this connection it may be noted that both the gorilla and the orang-outang can wield sticks, and that baboons can throw stones very straight and roll rocks down a hillside.

"To the late arrival at maturity of the offspring, which might not take place until several others had successively put in an appearance, and to the the duty thus entailed on the parents of providing them with food and protecting them, may be ascribed the first incentive to the exercise of the mental faculties.

"From what has just been said it can be seen that the principal factor affecting the life history of earliest, and still scarcely recognizable, type of man is the length of time after birth before the young attain maturity. This is the beginning of family life and the social instinct.

"There is one characteristic in apes and monkeys of the present age which probably existed also in their progenitors, and which is perhaps more active in them than in any other species of animal. At any rate it seems to be so in captivity, no matter how long tamed. I refer to the spirit of destructiveness. It may be owing to an excess of physical acticity that this feature is so largely developed. So opposed is it to any such instinct as food-storage that it actually renders the latter unthinkable.

"This somewhat highly developed instinct of destructiveness must have taken a very long period to neutralize and restrain, and in consequence acted as a greatly retarding influence on rising mankind. In fact, from the intellectual point of view, but of course not from the physical, ants are far more fitted to be the progenitors of man than are some simian species. Not everything, however, in this world has depended or depends on intellect.

WHY PROTO-MAN BECAME CARNIVOROUS

"When first Proto-man had to leave a forest region, where alone there is an abundance of food the year round, of the kind he had been accustomed to, he would have to resort to the picking of grass seeds, or munching the leaves of such trees as were not deciduous, or else digging for roots. Failing that, he would have to become carnivorous, for part of the year at all events. That eventually carnivorous habits became common is amply proved by the remains found in the cave deposits. These are all in the temperate regions of the earth, and since none has hitherto been found in the tropics, it would seem to be a fact that whilst he rem ined in the tropics earliest man was purely vegetarian like his simian prede essors.

"The next move on the part of man's predecessors was the most important. It consisted in a move to regions less abundantly supplied with food, and where he had to exercise his wits to live. In time it developed into a period of hard struggle. We are now approaching the time when abundant relics of this stage of mankind are to be found.

"We must now try to visualize man as he was at the stage when he could first be called *Homo primigenius*. ortunately we have some remains to assist us. He appears as a hairy creature with skin of an uncertain brown color. In bodily size he approaches the average modern man as regards height, but with a longer body and shorter legs. The legs were bandied, and as a result the creature will have a wobbling walk. The arms will be long. The head will have small frontal development, but be large behind, and probably dolichocephalic. The nose will be flattened and broad at the base; the jaws of great power but the chin very receding. His eye will be black and small but piercing, and overhung with heavy bony ridges. Perhaps this description may recall a gorilla more than a man. Indeed in most ways he was not far removed from the former.

CLOTHING A LATE ACQUISITION

"He will be unclothed, and for a dwelling will seek a cave if in a mountainous country. Hills with caves are, however, the exception rather than the rule, and so for the most part his home will be beds of leaves or grass in the more inaccessible thickets, with rude shelters of roughly thrown-together branches. The absence of clothing will prevent his migration of his own free will into the more unfavorable regions to the northward, and it will not be until he has learned to make use of the skins of animals as a protection against

weather that he will wander far out of subtropical latitudes.

"It would at first sight seem to be a very simple matter to kill a fur-bearing animal and wear its skin. It must be borne in mind, however, that in the subtropical regions fur-bearing animals do not exist, or only at high altitudes. They are large and fierce animals, and so far man has not acquired the skill or understanding to make a dart or weapon to kill them with. If by some rare chance he did manage to kill one when attacked by it, he has next to skin it, and this is impossible without the equivalent of a knife, which he has not got yet. Then, too, he would want ashes to rub on the skin in order to preserve it, and he has not fire yet at the stage at which we are considering him. He must, therefore, have advanced considerably in the arts before he could clothe himself in the skins of wild beasts; in fact, he must be already well advanced in the stage of *Homo primigenius* before attaining to this stage of culture. Another point is that in the tropics and subtropics many of the animals are hairy, except those of the cat tribe. Certainly those that it would be easiest to kill are hairy, and a rough, hairy skin would be no desideratum to wear.

"On the whole the cold would have to become very great before the need of clothing, if due to that cause, made itself felt. Man at that time was practically equal to the beasts in his ability to stand cold if the transition of the race into a cold region was not too rapid. We have the example of the Fuegians who are practically unclothed, or were until comparatively recent years, and, unlike proto-man, they are hairless. That cold was the cause of the adoption of clothing is, as we shall see later, most unlikely. It began first as a means of adornment, and it was not until it was practiced for that purpose that its extension as a means of protection came into use.

IMPLEMENTS PROBABLY UNKNOWN

"As to implements, proto-man would at first be without any, and would have no more knowledge of their possible use than such as he had derived from his simian predecessors who could throw stones and roll down rocks like the baboons of the present day, or use a stick spasmodically like the orang-outang or gorilla.

"The manner in which he would make use of a stick at first is somewhat uncertain. As a thing to be thrown, we can of course accept its use, but that he would systematically take a stick about with him is unlikely. He would be too irresponsible for that. If he were attacked, or wanted to attack, he might break one off and make use of it, only to drop it immediately afterwards. Man was still at this stage without thought for the future, and certainly would not take a stick out in the morning when starting off to feed, as some drawings made of early man in recent years would seem to suggest. It would only be an encumbrance, and to accept an encumbrance with a view to future contingencies becomes a sort of insurance, implying an enormous advance in forethought, and taking a measure of the future. The use of a stick would, therefore, be on the spur of the moment, and chiefly to throw. In the ordinary course of life he certainly would not be bothered with a walking-stick. It would, besides, imply ownership, and we have not shown him as owning anything yet.

OWNERSHIP AN IMPORTANT FACTOR

"As ownership is an important factor in man's development, being the beginning of capitalization, without which there can be no progress, we may here stop to consider what nature of things man was first likely to collect or desire to have by him, once used to be used again.

"It is possible that utility will not have been the first consideration in this respect. Rather it will have been things that please the eye.

"He has already the faculty of bringing home things in the nature of food supplies for his young. If he meets some striking object, such as a brilliantly colored pebble, it is likely that with his dawning intelligence he will pick it up and take it home as a matter of curiosity. To pick it up, and look at it, or lick it,

and drop it again, is possible and may happen countless times, until one individual, not forgetting his family at home to whom he is carrying food, will take the strange new thing with him. Indeed some birds will carry off bright objects, mentioning which we may recall the celebrated jackdaw of Rheims.

"On another day he has picked the vivid-hued feather of some gorgeous tropical bird. He looks at it, and takes it home stuck in his hair for convenience of carrying. On his arrival it at once strikes the eye of his wife and children. Signs of pleasure are expressed. His vanity is flattered, and here we have man beginning to adorn his person.

"In reviewing the possible circumstances attending the daily life of proto-man . . . and considering his few requirements and small metal activity, we may perhaps assume that it was in connection with his food that the first use of an implement took place.

"Let us take a nut too hard for him to crack with his jaws, and banging it down is also without effect. His next act is to take a stone and crush it. Yet there is no originality here, since monkeys in captivity have been observed to do the same, and, further, to hide the stone for future use. The only point we need therefore note in this connection is that stones can readily have come into common use for such a purpose with earliest man, who is now acquiring greater intelligence.

"The next stage that may be considered is the additional use of stones for producing music or noise. It is said that a gorilla practices a sort of music by beating trees with a stick in addition to striking his chest for the sake of hearing the resounding noise. There is therefore the association of striking with pleasant sounds. Proto-man similarly found out early, even if his progenitors had not already done so, that stones could make a pleasant rattling sound when thrown on a rock, and could render the noise as pleasing as he liked by merely adding to their number.

"Man has, therefore, to sum up, turned to the rough stones which he can pick up anywhere for his first implement. Three uses are established: that of throwing when attacked; for throwing and hearing them resound, and for breaking up hard nuts, with a hint of a grinding motion.

"In addition to the use of a stone implement, he has acquired some idea of personal adornment and a rudimentary idea of music as well. These mean that both his eye and ear can receive impressions of other than a purely utilitarian nature. His taste for new foods is, however, undeveloped, and only forced on him by necessity, owing to failure of something to which he is accustomed. Unclothed, and still with only the rudest form of shelter, he lives a family life, and the new generation as it becomes adult tends to separate and form new families which move farther afield in search of new food supplies.

THE DAWN OF ART

"As far as we have reached in the course of his evolution man has not advanced beyond the stage of making an uncertain and spasmodic use of a few objects in their natural state. We must now make an endeavor to think out how he could have begun to work on some of these natural objects so as to adapt them to a specific purpose which he may have had, necessarily in a vague sort of way, in his own head.

"The assumption may be made and adhered to that it was on stones that earliest man first exercised his handicraft. Nevertheless between using any stone that came to hand in order to crack a nut on a rock, and breaking it or chipping it for a specific use, lies an enormous gulf, and this we must endeavor to bridge.

"As a possible hypothesis, what may have happened is that a certain Proto-man whilst digging for roots with his bare hands, met some obstructing stones. These, like monkeys of the present day, he would pull out and throw aside. Early man, though, has already a dawning intelligence, and is, as we have shown, not unfamiilar with handling stones. As he burrows, he comes on a stone that scrapes the skin off his fingers. He grips—and, instead of throwing it away, still grips it, and goes on burrowing.

"He has learned that a stone helps him to dig. Later he finds he can burrow more quickly or more easily with some stones than with others. Some really impede him. He cannot get on with them at all. So gradually he gets to know the kind best suited to his use.

"Then at last the miracle comes. It dawns on his feeble intelligence that a broken and sharp stone is better suited to his purpose than a smooth one, and that he can produce such a stone as he requires by breaking a big one. One individual alone has found this out, and the others make use of his discovery, which is that if a broken stone cannot be found, they must break one for themselves."

Such stones, broken in greater or less amount, are found in many places, and called eoliths. "It was at the age of eoliths that man's wider dispersal began, and according to the evidence furnished by the distribution of eoliths a big wave spread in the direction of northwestern Europe. In what other directions the spread took place has yet to be found out. It awaits further excavations on an adequate scale in other parts of the world."

USE OF FIRE OF VAST IMPORTANCE

It is by this time necessary that man should have acquired knowledge of how to use fire; and he may have learned this from either lightning or volcanic fire.

"Earliest man, like the beasts of the field, must have been for long ages accustomed to fire before it ever dawned upon any one individual to try to make use of it. Their intellects had not hitherto led them to that. It was universally regarded as an object of fear to be fled from to save their lives. As a great conflagration died down, some of the more inquisitive animals such as apes and monkeys may have gone to the extent of warming themselves by some smouldering tree after being chilled by a sudden storm of rain. Early man may even in times of dearth have tasted and eaten the roasted remains of some small animal that failed to escape the fire in its advance. It must, however, be here noted that as a matter of fact bush fires advance very slowly, certainly in the grass country of Africa, and not on a very broad front. For any animal to be caught and burnt is therefore an exceedingly rare occurrence.

"From such tentative uses of fire nothing could have resulted unless man had already acquired the mental capacity to make use of external material. No improvement has resulted from the acquaintance of animals with fire. Even the intelligent dog, who is always with man, and thoroughly understands the warming properties of fire, makes no attempt to further utilize it, and has not the least capacity to make it up when it sinks. It was not until, in the course of ages, man with an intellect capable of developing, had acquired the use of one art after another, if only in a small way, that he was sufficiently advanced to recognize the properties of fire; and it must, of course, be recognized that in his mental development every addition to the list of arts would react on his mind and predispose it to further efforts.

"As to the first stage, we have already seen that he may have met in the track of a grass fire the body of some animal that had failed to escape and been burnt to death. Having tasted it in the possibly ensuing dearth, and having found it good, the attention of others may have been drawn to it, and they too ate it with appreciation. This appreciation may take a dual form. The vegetable food supplies on which they relied may have been burnt up to a greater extent than usual, and so the zest of hunger would be brought to the newly found food, besides its being liked for itself alone as an occasional dainty. As regards the question of the possibility of a change of food being adopted, we have only to remember the remarks made earlier about the Kea parrot of New Zealand when such possibilities were discussed."[3]

Man might catch something for him-

[3] As one of the best authenticated examples of how the lower living forms can change their diet may be quoted the Kea parrot (*Nestor notabilis*) of New Zealand. Like other parrots this species was formerly purely vegetarian. In the middle of the nineteenth century, however, the English settlers introduced sheep. Apparently a time of scarcity of the parrot's own food came,

self and roast it in some smouldering tree, but he could only do this when a fire had appeared naturally. "For the next stage in the development of the use of fire by man, we must go back to the chance fire brand brought home. One day such a one was carried back. Hitherto all had died out in a brief space of time, and that same evening saw them cold and black. On one occasion one was still glowing next day. A faint breeze fanned the place where it lay, or it lay close to another stick, and the spark did not die out. This was a phenomenon and a source of wonder. It was a new discovery and, many inventions being due to accidents, we may even imagine a fire-stick setting light to the heaps of dry leaves on which they slept, causing a hasty and alarmed retreat.

"It was the fire-stick burning until next day that undoubtedly made the impression on the mind of some one individual of the race of earliest man that there were ulterior possibilities. It was he who first discerned that some sticks burned longer than others. Perhaps it was on some other individual that the perception dawned that with a faint breeze to fan it, it held fire longer than another stick less favorably placed.

"Even with these phases duly recognized, a strong mental impulse is still necessary for such individuals to make use of them, and so secure the life of the fire. This can only be effected by adding more fuel; and it would further require an individual advanced yet a little beyond the others to think that if one stick unkindled be joined to another alight, it will catch the fire and can pass it on to yet another stick. All these processes are simple and obvious to us at the present day, but we may be sure that in the early stages of mankind they were reached only after long successive periods. This means that man played with fire long before he possessed it not to lose it again. We should still be without fire at the present day had not one of our progenitors succeeded, more by accident than by design, in keeping a fire smouldering for a lengthy period. It may be a heap of leaves was set alight and continued smouldering; or a wind-driven or water-borne accumulation of gases; or a tree-stump which held the germ of fire and lasted out for days, if not weeks. Any one of these would serve as a source from which fresh supplies of fire would be drawn as needed.

POWER OF IMITATION STRONG

"With the power of imitation that is almost an instinct with primitive man, either at the present day or when all mankind was primitive, some one individual would do what nature had done, and once done and a repetition of the act being accomplished, the power to do so again would forthwith become common property, at least in a restricted circle or in a particular locality. They would cherish it carefully and hand it down to their descendants, and any human beings outside their own home or tribal circle would only acquire the same with difficulty from the owners, probably by force or theft. It would scarcely be by favor, for at this early age we may presume that the moral idea of favor would be unknown. The possessors of such a valuable acquisition as fire, keeping it to themselves, would soon advance rapidly beyond their neighbors. The latter, unless united with them or absorbed into what has become practically a superior race, would remain behind in the general intellectual advance of at least a portion of mankind; and, if they did not die out, would only survive as an indication to later ages of how their progenitors existed in prehistoric times.

"The duration of the stone age covers by far the greater portion of the time of

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and this bird at once developed carnivorous instincts, and of a nature distinctly surprising. At first it began to feed on the offal of sheep from the slaughter houses, but later turned to the living animals, chiefly the lambs, attacking them on the back to get at and devour the kidney-fat, the death of the animal attacked being of course the result. The whole of the parrots of New Zealand could not have, in a single day as it were, decided on a new line of feeding, and have all set out together on a new career of flesh-eating. One single bird, driven by the stress of hunger, must have made the first attempt, and have communicated to others that sheep-flesh was agreeable; so that the rest of the parrots of this species lost no time in becoming meat-eaters, and meat-eaters of a very refined and specialized order.

man's existence on the earth. . . . In the beginning, when man first seized a stone to help him get through some hard or stony ground in burrowing for roots, he was scarcely out of the purely simian stage. His brain was small, the forepart undeveloped, and his jaws massive. Long before the end of the stone age, indeed before the end of the paleolithic age, he emerges a complete man, the true *Homo sapiens*."

The paleolithic age marks the time when man acquired added skill in making stone implements. Many other rude arts, such as pottery and weaving, must have been acquired at about this time, Mr. Migeod thinks. It was a period of rapid mental development: "This would entail his power of speech developing too. When at length the end of the paleolithic age came, it may be accepted that man's speech was sufficiently developed to be recognizable as the speech of *Homo sapiens* as it might be at the present day among the less advanced people of the earth who are without a literature.

"That this is so is shown unmistakably by the advanced stage of all the arts at the end of the paleolithic age in Europe. All the then existing arts indicate cooperation and a multitude of social activities. None of them could have had their existence without a ready means of vocal communication; and terms would already have been invented that would cover every conceivable subject in the sphere of man's comprehension in those ages.

"Eolithic man was left behind as scarcely a true man yet. He was at best *Homo primigenius*, not *Homo sapiens*. During the paleolithic age he became the latter.

HOW SPEECH BEGAN

"It will be useful to consider what can have been the primary moving cause of the production of speech. This is, in the writer's opinion, the same as that which has originated the arts, and that is the instinct inherent in all living things, whether of the animal or vegetable world, to propagate their species.

"It is this instinct that makes plant life one season of the year put on its most vivid dress. It is this same instinct which makes living things do the same. At the breeding season male birds put on their most brilliant and gorgeous plumage. Various animals, too, have given to them some change in their appearance. It is at the spring, or corresponding period of the year according to the latitude, that this new energy pervades the world. Animals which at other times of the year have no instinct except to feed themselves, at this particular season develop new faculties. Some birds know all at once how to build the most elaborate nests for the expected new generation. Many animals begin to look for comfortable homes where their young can be reared in safety; and, above all, their voices are heard as they are heard at no other season of the year.

"Now what is the nature of the sounds that come from all these birds and animals? There is a school of thought that tries to reduce all human speech to original roots, and to find a minimum of basal roots that they can point to as the first beginnings of human speech. It would seem, however, that there is something wrong there and out of harmony with the observed facts relating to animal life in general, and to simians in particular. One hears monosyllabic utterances, if such they can be called, proceeding from animals, it is true. Much more commonly it is a complex or polysyllabic sound, largely influenced by tones. Monosyllabic sounds cannot, of course, be absent, for the simple reason that if there are sounds of two or three syllables it is hard not to conceive a monosyllable possible. Such monosyllables are interjections or commands, and are entirely non-descriptive, such as may be the multiple utterances of which so many animals are capable. As to what these multiple sounds mean, man has, of course, but little means of knowing, any more than he knows a strange language on first hearing it. The fact remains, however, that one or more ideas are conveyed to another being of the same species. The unit of predicative speech is therefore a compound or multiple utterance, or in other words a complete phrase.

"It may perhaps be assumed that cries to his mate would be the first form

of voluntary utterance by a sentient being, and cries of pain or distress the first involuntary ones. . . . To cries of the first nature might be added in turn cries indicative of pleasure. These latter would be largely personal."

After self has been recognized, the outside world would be taken into cognizance. Food will be an important subject; hence means of expressing the relative position of place would take precedence of time.

In all man's progress, Mr. Migeod ascribes an important place to geologic changes, which kept him moving and gave a new environment, which called forth and selected new attributes of his mind. "This steady movement brought higher races into contact with lower races. If sufficiently numerous or powerful in proportion they absorbed or destroyed them. If they did not succeed in maintaining their superiority, they themselves were liable to degenerate. So the reaction one on the other has ever continued, till at the present day, we find the highest evolved type meeting the fragmentary remains of unprogressive types of earliest pre-humanity, and in the shape of gorillas and orang-outangs treating them as wild beasts to be destroyed when met with."

Additional Facilities for Army Medical Museum Needed

Urging the importance of additional facilities for the Army Medical Museum, Major R. W. Shufeldt in the *Medical Record* of October 20, 1917, states some striking facts regarding the heavy burden of work which is placed on the Museum by the entrance of the United States into the world war, the invaluable aid to all scientific work which it will do if facilities are provided, and the entire inadequateness of present equipment.

Early in the Civil War, steps were taken to collect together material of every description relating to military practice of medicine and surgery, consisting of specimens collected at post mortems and all kinds of military equipment. This material was housed in the old Ford's Theater on Tenth Street. To the specimens were added all the field reports and special histories of the great combat. Although it was soon seen that Ford's Theater was entirely inadequate to house the valuable material, nothing was done until a floor collapsed and several clerks were killed or injured. The government then supplied the present building.

This collection of enormous value is already vastly too large to be housed in the present building, which as Major Shufeldt points out has been for years a supreme joke. Since entirely different methods are now being used from those of the Civil War, a new museum of vast capacity to house the materials which will soon come flowing in in a huge stream is an urgent necessity. All this will require appropriations by Congress for a new building and adequate equipment to be placed under Colonel Owen's control.

War Makes Large Demands upon Horse Breeders

That the steady drain of horses and mules to the war fronts will cause a great scarcity of animals after the war is the opinion of the *American Red Star Animal Relief*. Whatever surplus America may have had is likely to dwindle before the Allied nations have satisfied their needs. From many breeders comes the advice that every good mare should be bred during 1918, in order that America may be in a position after the war to restock Europe.

Losses in the U. S. Army alone during the period of six weeks ending January 12, 1918, amounted to 4,777 horses and mules, which represented, at an average purchase price of $175 each an expenditure of $835,975. A great proportion of these deaths resulted from influenza or "shipping fever." Up to the present time no satisfactory treatment or preventive inoculation has been devised for this disease.

Since the beginning of the war, the animal strength of the U. S. Army has been increased from 66,145 to 344,000, the War Department has announced.

DECADENCE OF HORSE BREEDING

Impending Crisis in Whole Breeding Industry—Imperfections Found in Present License Laws—Differences between Congenital and Acquired Defects not Always Made Plain—Unsound Mares a Menace—Actual Breeding Test often Contradicts Theoretical Forecasts

HENRY M. JONES, *Lexington, Ky.*

THE article "Better Horses" in the November JOURNAL is most pertinent, coming as it does at an impending crisis in the whole breeding industry. However, the writer wishes to enter a protest against the license system as a means of eliminating congenital defects or undesirable blood lines. The license laws that I have examined do not prohibit the use of either defective or scrub sires but merely require that all unsoundness, either congenital or acquired, be made public. Further, these laws do not prohibit the use of unsound mares for breeding. It is true that a congenitally unsound mare produces but one foal in a year, still that foal may be a stud and be a greater detriment to the breed than the older horse. In the first place, none of these laws define congenital unsoundness nor do they prescribe any test by which congenital defects can be separated from acquired. A congenital defect exists at birth. Biologically, this is the only defect that can be transmitted. It is unthinkable that any breeder would keep entire a colt that was foaled blind, or with any other of the numerous unsoundnesses that these laws class as congenital. There is but one test of any congenital character, and that is the "actual breeding test." It may be well to refer to the history of some noted stallions that would have been placed under the ban by these laws.

NOTED THOROUGHBRED BLIND

The noted thoroughbred stallion "Lexington" was blind through the greater part of his stud career. Yet he founded one of the greatest families ever known, not one of which inherited weak eyes. The most prominent living thoroughbred sire is blind. Yet he has never sired a blind colt and his produce are selling for higher prices than any other sire.

Two of the most noted living trotting sires would be branded as congenitally unsound, as one has a bog spavin and the other is string halt; and yet each has sired champions and founded families that are as free from this unsoundness as any other family. It is not invidious to mention the names of the noted sires now dead, that were blind. Especially is this the case as the present writer bred to each of them and now has their blood and factors for unsoundness (?) incorporated in his greatest brood mares, line bred and inbred, for four generations, and yet has never had a blind foal or a horse with weak eyes, although some of them reached the age of twenty-five years. The stallions referred to were Simmons, Wilkes Boy, Jay Bird and Eagle Bird—all of which were blind, yet the large families left by each of them are as free from blindness as other sons of the immortal George Wilkes who were more fortunate. If these horses were congenitally unsound, the factor must have been transmitted by their sire George Wilkes or by the dam's family—which was by Mambrino Patchen.

ACTUAL BREEDING REAL TEST

To publish to the world that these two greatest of all progenitors of trotting speed transmitted factors for blindness is to condemn the best families of the trotting breed. To this breeders will not willingly submit nor will they submit to their life work being stigmatized by theoretical laws when the "actual breeding test" disproves their efficacy. The

A NEW YORK STREET BEFORE THE ADVENT OF THE AUTO

Prior to the advent of the automobile, those horses which did not prove to be winners in the racing game found a ready market for work such as that pictured above. Mere lack of extreme speed did not impair an animal's value for such a use, and there was sufficient demand for good sound horses to utilize all the surplus from the race-track. Photograph by Underwood & Underwood. (Fig. 9.)

writer yields to no man in appreciation of the forces of heredity, for in early youth, when scarcely able to understand biological problems, "Origin of Species" was a nightly study, and from then to the present day the best authorities are constantly on hand. With information thus gained, and thirty-five years of practical experience in breeding, we do not feel the need of legislation to protect us, nor would we change the selection of blood lines for future mating under any conditions.

RECOGNITION OF RACING DEMANDED

As for protection from congenital unsoundness, the experienced breeders judgment is a greater safeguard than any legislation, and as protection against false blood lines the register has long since eliminated the chance of fraud and no breeder of either standard or thoroughbred horses could be induced to patronize a stallion that was not registered. (However, there are many inexperienced breeders who are not sure of their ground. The greatest breeding is that of draft horses, as may be seen by the records of the states having laws.—The Editor.) The protection breeders need is the recognition of racing by the Government as a legitimate business, for racing is now the only incentive to breed. But, with only one state having legalized racing and existing by sufferance in all others, the breeding industry is on a most unstable foundation. Each new legislature has some members who for gain, politically or financially, attempt to introduce adverse legislation. The report now comes from Maryland that the lower house of the 1918 legislature will be solidly against racing in any form in that state. The Detroit Driving Club, which for many years has been one of the leading associations of the Grand Circuit and has made two stakes classics, which has given to the winner a high value either for breeding or racing, has had to quit on account of adverse legislation. When the Hart-Agnew law was passed in New York it cost the State of Kentucky alone $5,000,000. The great breeding establishments were compelled to ship mares to South America, Australia, France and other foreign countries to find sale for them at any price. After Kentucky placed racing under a State Commission, some few have continued breeding, but to-day the production is not one-third of what it was formerly.

The breeders of the trotting horse are facing conditions that are unique in a way and have been brought about by the force of two factors, one of which could not be controlled; the other could. Prior to the advent of the motor, horses unsuitable for racing found a ready market for the road. Those of exceptional conformation were educated for roadster classes in the show ring or for the three gaited saddle class. But the motor has practically eliminated road driving and no other outlet has been found for this class of horses. In fact, the trotter now occupies the same position as the thoroughbred, distinctly a racing tool, but races under the worst system that could be devised. If not a stake horse his value is less than the cost of production, as he has little, if any, earning capacity. If of stake caliber, he acquires a fast record, then he is worthless for racing purposes as the associations do not offer purses of sufficient value for him to win more than expenses. Quite anomalous situation, the greatest merit the less value.

END THOUGHT DRAWING NEAR

This class of horse formerly found a market in Austria, Russia, Italy and other foreign countries, but the war has closed this outlet. The breeders, besieged on one side by the ever increasing use of the motor which cannot be controlled, and on the other by racing conditions that give value only to the exceptional horse, find no means of escape but to quit breeding. Only a few years ago any road that led from Lexington would reach the stock farms of several breeders, each equipped with a track and complete training plant; to-day there are four breeding farms in Kentucky and the farmers, who formerly kept six to ten good brood mares, have in the majority of cases sold them. A very few have kept one or two through sentiment, but farm them or breed on shares, and in every instance sell the foal to the

HORSELESS FIFTH AVENUE TODAY

Now that the motor driven vehicle has been proven successful along every line, the horse is being rapidly displaced from his former position as an indispensable assistant. This has almost closed the outlet for surplus race horses, and as conditions now stand, horse breeding is in many ways a losing game. The amount of land required as pasturage for one horse would pay a much larger increase on the investment if used for raising tobacco. Photograph by Underwood & Underwood. (Fig. 10.)

owner of the stallion at any price he may name. Not one of them is reserving fillies for future brood mares, and when the present brood mare holdings pass away or become barren, finis will be written.

The writer has handled stallions for many years and now has one of the most prominent stallions of the trotting breed and is intimately acquainted with breeders and owners of stallions throughout the U. S. and finds that what is true of Kentucky is true of every section where stallions are kept. The present decadence in breeding is not such as has been caused by financial panics, when breeders curtail operations for a while and reduce the brood mare ranks. In fact, these periodical reductions have been an advantage as it caused a weeding out of the lower class, reducing the number of foals but greatly improving quality. Our government, as is well known, is far behind foreign governments in encouraging improvement in stock breeding. In fact, even the state laws have thrown serious obstacles in the way. Kentucky has a license tax of one service fee instead of a bonus and the assessor never fails to raise the value to the limit. In Virginia a noted stallion was assessed at $50,000 and when sold at public auction only brought $30,000, quite discouraging to the owner who had invested close to a million dollars in Virginia land.

FAULTS OF PRESENT PLAN

The consensus of opinion among many breeders is that the present plan of the Government to improve horses by the use of its stallions upon grade and scrub mares cannot be entirely successful. It might be more practical to buy at the various auctions pure bred mares, placing them in the hands of farmers, requiring them to sell the geldings to the government at not less than $200 and keep the fillies to be bred at three years of age under the same contract. In this way breed improvement would be sure as grading is worthless in the second generation. (But a mare may have but one offspring a year while a stallion may have fifty. It is for this reason that it is of paramonnt importance to see that only pure bred stallions are used.—The Editor.) Under state aid it is only a matter of a few years when every county seat will be connected by roads of easy grade, and as smooth as an asphalt street. Every mile of such road increases the use of motor power and decreases the use of horse power proportionately. Particularly is this the case in the mountainous section of the country where coal and lumber are abundant and the horse has been used exclusively.

As stated, racing is now the only incentive to continue breeding, but conditions controlling trotting races are so arbitrary that the exceptional horse can win through the entire circuit without incurring a handicap until the following season.

There is no question that two- and three-year-old colts that can trot in 2:08 to 2:10 are high class, yet they cannot now earn expenses in the colt stakes as they have to compete with colts that can trot in 2:04 or better throughout the entire racing season. Such colts have no earning capacity and represent a far greater percentage of the breeder's product than the exceptional colt and yet cannot be sold for cost of production. This is the most discouraging feature of breeding and is the chief factor of the decadence of breeding the trotter. This could be easily changed if racing associations were controlled by either state or government commissions that would foster the breeding interest and at the same time not impose burdensome conditions upon racing associations. This is the most opportune time to place all racing, from the largest association down to the county fair, under a government commission. Such a commission should be composed of breeders and promoters of racing and should have the power to make and enforce all laws governing racing and speculation. Unless some such safeguard is found in the very near future, an industry which is wholly American will become extinct. The trotter originated in America and nowhere on earth has his equal been found, as no other breed of domestic animals has ever withstood the adverse conditions as long as this breed, but at

last has become a supplicant for its existence.

HORSE BREEDING AT LOW EBB

Economical conditions counted with the war would seem to be the final stroke to the decadence of breeding horses. It is estimated that 4 acres of the best land is required to pasture one horse during the grazing season, that is from April to December; then the expense of feeding during the winter additional. This class of land planted to tobacco will now yield a net profit of $200 per acre, to hemp $150. In fact such land readily rents for these crops at $50 to $75 per acre. These crops are matured and marketed in eight months, whereas the horse must be three years old before the Government will pay $150 for him, and then must be sound and of good conformation. Land that nets in tobacco $200 per acre for three years would figure the cost of each three-year-old $2,400 for grazing only, that is, the land required to produce one three-year old would net the owner $2,400. Consequently the only chance of profit in breeding is to produce the exceptional horse that will bring more than this amount. Unfortunately the pure bred animals have not reached that state of perfection where predictions are fulfilled with sufficient constancy to reduce the percentage of by-product to a point where profit can be made.

STEPS TAKEN IN CANADA

Canada has begun to eliminate horse breeding, to take up breeding of dairy stock. In fact, any other agricultural pursuit now promises more than horse breeding. This is no idle carping of disgruntled breeders, but plain facts stated far less forcefully than conditions demand. It is rather an appeal of patriotism to save one of the most efficient aids to win this horrible war and an indispensable necessity in peace.

Inheritance of Diathesis through Five Generations

An interesting addition is made to cases where a tendency toward disease seems to be definitely inherited by the report of Drs. Joseph R. and Thomas R. Crowder in *Archives of Internal Medicine* of angioneurotic edema occuring through five generations. The disease is characterized by transient local swellings in various parts of the body, generally accompanied by gastro-intestinal disturbances. The etiology is obscure.

About 1820, being a young man and recently married, J. C., took a contract in a logging camp of Pennsylvania. He had an attack of illness which was believed to be quinsy, in which the neck was greatly swollen. From that time on, the swellings were repeated at various intervals, invading all parts of the body, and proved fatal through the involvement of the throat twenty years after the first attack. Previous to his attack in the logging camps, he had never suffered any such malady, and there was no record of such trouble in his family or relatives.

This man was father of ten children, all but one son were afflicted with this peculiar malady and seven of them died from its effects. Seven members of this generation left children aggregating twenty-nine, and of these, twelve were afflicted. In only one of the seven groups of children were all the children free from the disease. In the fourth generation there were seven groups of children comprising eighteen children. Nine of these are descended from affected parents of whom five have the disease. The nine descended from unaffected parents are all free. The fifth generation contains up to the present time only six members. Three are daughters of an unaffected mother and are all free from the disease. Three others are the daughters of an affected mother and only one of those has so far shown any taint.

A NEW SCIENTIFIC JOURNAL

American Journal of Physical Anthropology to be Established in Near Future—Dr. Ales Hrdlicka of National Museum Is Editor and Founder—Scope Will Include Every Phase of Modern Physical Anthropology

IN THE history of the development of every branch of science there comes a time when the establishment of a medium of publication devoted to that particular branch of research is essential to its full development. It is a peculiar and regrettable circumstance that physical anthropology has remained thus far without adequate facilities of publication and without a journal of its own in this country, the richest in the world in the subject-matter of that science. Notwithstanding the fact that most European countries, including even Portugal and Switzerland, have each from one to three journals devoted exclusively or largely to physical anthropology, and that some of these have been published continuously for more than half a century, no effort has yet been made on the American continent toward the establishment of such a periodical. It is true that we have the *American Anthropologist*, but that journal is devoted to anthropology in its broadest sense, and its pages are practically preempted by the more popular branches.

It is urgently demanded that these conditions be remedied and that a journal devoted to the interests of physical anthropology be established. The time is ripe and the opportunities for development are unsurpassed. The war has now involved this country as it involves practically the whole white race, and the unprecedented conditions that have arisen in consequence bring forth a legion of new anhropological problems, as well as exceptional opportunities for research.

The proposal to establish a periodical devoted exclusively to physical anthropology has been presented successively to the Subcommittee on Anthropology of the American Association for the Advancement of Science, the Committee of One Hundred on Research of the same organization, the American Anthropological Association, the Smithsonian Institution, and the Committee on Anthropology of the National Research Council, by all of which it has received unqualified approval.

More than mere approval, however, is required. Energetic promotion is demanded and financial considerations insist on presenting themselves. The establishment of a scientific journal that cannot expect a large circulation calls for means by which the periodical may be supported for a period of years or until its income from subscriptions equals the expense of publication. Careful estimates indicate that aid to the extent of $1,000 a year for three years would insure the publication beyond question; and it is proposed to make an especial appeal for this support, an appeal which must be largely to individuals, since institutions generally find their rules and regulations a serious obstacle to the devotion of funds to the promotion of a periodical not issued under their direct auspices.

Thus so much for the reasons which have actuated the founder, Dr. Ales Hrdlicka, Curator of Anthropology of the National Museum, in undertaking at this critical period, the publication of the *American Journal of Physical Anthropology*, and for its first needs. Application to his colleagues for editorial assistance has met with the most encouraging response, and there is substantial hope that adequate aid will be given by devotees of the subject toward developing the *Journal* and making it of substantial scientific and public utility.

The *Journal* will probably appear in April and will include research and special articles on man's origin, development, variation and present status, everything of anthropological interest connected with the war; descriptions of American collections, their field work, installation and exhibits; the objects, history and methods of anthropometry in general; reviews and bibliography and anthropological news and notices of current interest.

FAMILIES OF SIX GENERATIONS

Two Examples of Early Marriage and Child-Bearing, with Extreme Longevity—Transmission in Both Cases Through Females—Few Similar Authentic Cases on Record

FAMILIES of six living generations are found so infrequently that the two cases reported by Dr. George M. Gould are of more than usual interest.[1] Although cases of extreme longevity, and families of even as many as seven living generations, are reported from time to time as occurring as far back as the seventeenth century, modern methods of keeping vital statistics have shown that such reports were without doubt highly exaggerated. The two photographs published herewith, however, were both taken in September, 1908, and the cases are for this reason well authenticated. Both families are well known in their communities and their striking records are well vouched for.

AN UNUSUAL CASE

The first of these twentieth century cases is the Shrake family, of which

SIX LIVING GENERATIONS

Although families of four living generations are quite commonly found and an occasional report tells of five generations, groups such as the above, including members of six living generations, are exceedingly rare. Other things being equal, the chances of a long life are greater for this babe in arms than for the child born of parents whose own parents have already passed away. Photograph by courtesy of Dr. George M. Gould and *American Medicine*. (Fig. 11.)

[1] Dr. George M. Gould, *American Medicine*, September, 1917.

DESCENDANTS IN FIVE GENERATIONS

Equaling the achievements of the Shrake Family, the Passes present another peculiar case where longevity combined with early marriage and child bearing produced six living generations. It is peculiar that in both these instances, the transmission was entirely through the mothers. Photograph by courtesy of Dr. George M. Gould and *American Medicine* (Fig. 12.)

Mrs. Lydia Thomas Ault Shrake was the oldest living member. The following details have been gleaned from newspapers, family letters, and fellow citizens and acquaintances of the family who were residents of Wyalusing, Grant County, Wisconsin, about five years before the death of Mrs. Shrake.

Mrs. Lydia Thomas Ault Shrake was born in Cornelsville, Pennsylvania, in 1814. At the age of eighteen she married William Ault. Five children were born. Mr. Ault died in 1839, and two years later Mrs. Ault married Jacob Shrake. Again five children were born. "Grandma Shrake" sent five sons to fight in the Civil War.

Margaret Ault Elder was born in 1835 and married at the age of fifteen, and, at the date of this quoted report had borne ten children, seven of whom were living.

Rachel Elder Goff was born in 1851 and married at the age of seventeen. She was the mother of twelve children, seven of whom were living at the time of the report sent to me.

Melissa Goff Spaulding, born in 1873, married at fifteen, became the mother of three living children.

Cora Spaulding Gulley was born 1891, married at the age of fifteen, and had one child.

Agnes Elder Goff Spaulding Gulley was born August 5, 1908.

COMPETITION BETWEEN FAMILIES

Mr. Brookens of Bloomington, Wisconsin, wrote in 1909 that he photographed five generations of the Cooley family, "the eldest lady in this case being about ninety years old." "It was a tie between the Shrakes and the Cooleys. No one ever thought that either family would be able to produce the sixth generation before the chain was broken; but the young Miss Spaulding married a young Mr. Gulley, and with only a few weeks to spare brought forth the baby which has made the family renowned."

Mr. Brookens adds that "these people live from 14 to 20 miles from my studio. They had planned to have a big gathering at the home of No. 2" (*i. e.*, the first of the upper row in the photograph) on her 79th birthday, September 4, 1908, and I had been engaged to make the photograph that day, but No. 2 died August 30 and was buried September 1. On September 4, as prearranged, the five living parties were photographed and I copied from an old photo the deceased lady. So you see that all six generations were living from July 25 to August 30. The oldest lady is ninety-five past, she has 41 grandchildren and 167 descendants.

"Margaret Elder died about twenty days after baby Gulley was born."

The five mothers married at ages 18, 15, 17, 15, 15, thus averaging 16 at the time of marriage.

Minute details regarding the Pass family, the second family to have six generations living at one time, are lacking, but the following facts can be vouched for as coming direct to Dr. Gould from immediate members of the family.

Anna Maria Pluck of Pennsylvania was born October 15, 1808, and died October 23, 1908. She married Isaac Pass, great nephew of Jacob Pass, in whose foundry (Pass and Stowe) was recast the Independence Bell.

EXTREME LONGEVITY

Her daughter, Margaret Elizabeth Pass, was born March 7, 1837, married Thomas David. Her daughter, Lillie David, was born August 8, 1853, and married Mr. Sayres; a daughter, Lucy Sayres, was born February 2, 1872, married Mr. McDade. Emma McDade, daughter, was born November 8, 1888, and married Mr. Feinman; their child Celestes Feinman, was born on July 1, 1907. The photograph, here reproduced, was taken either on the 27 or 29 of September, 1908.

The longevity of a century in each case, together with early child bearing and unusual fecundity, make these cases almost without parallel. It is to be hoped that other investigators will be able to discover similar families and to furnish additional data.

The Effect of Recessive Factors[1]

If we have two plants with a pair of contrasted characters inherited in alternative fashion, we are obliged to consider these as consequences of the presence of alternative factors, *A* and *a*, in the germ-cells. Then we usually can only compare the effects of the factorial pairs *AA*, *Aa*, and *aa*. We usually know nothing as to the effect of *A* alone or *a* alone, or of *aa* in the presence of *A*, etc. The work of Hayes and East on triploid inheritance, makes it probable that in the endosperm of maize, in a certain pair of factors, *Aaa* produces the same effect as *aa*, and *AAa* the same effect as *AA*. Here both factors of the pair have a definite influence. Some influence of the recessive factor is probably indicated also in Morgan's crosses of certain sex-linked factors in Drosophila, where the heterozygous female *Aa* differs from the male *A*–, in the particular character. In cases classed as multiple allelomorphs we consider both factors of a pair as producing definite effects. According to the presence and absence hypothesis, the recessive factor (or one factor of the pair, where the heterozygote is clearly intermediate) is always zero. This hypothesis seems to have experimental support, only where the effect of *Aa* is apparently the same as that of *AA*. A study of the inheritance in tetraploid primulas with special reference to any influence of the recessive might be fruitful.

[1]Hays, H. K. and East, E. M. Further Experiments on inheritance in maize. Conn. Agr. Expt. Sta. Bull. 188, 1915.

A NEW FORAGE PLANT

Russian Sunflower of Great Promise for Irrigated Mountain Valleys of Northwest —Crop Stands Ten Feet Tall and Keeps Down Weeds —Is Valuable for Silage.

F. B. LINFIELD

Director of Montana Agricultural Experiment Station, Bozeman, Mont.

IN ALL new agriculatural countries the farmer's first problem is to subdue the native sod and replace nature's crop by something of greater economic value. The soil is generally rich, and quite free from weeds. By the adoption of crops best suited to the climatic conditions, provided an ample water supply may be provided, good crops are possible for many years. Sooner or later, however, the farmer runs up against two difficulties if he continues to grow grain exclusively upon his land. A reduction in available plant food reduces his crop yields to the point of vanishing profits and weeds also cut into those profits by increasing the amount of labor necessary to get a crop, or they may even crowd the crop out altogether.

SOIL ENRICHMENT NECESSARY

In any system of farming, therefore, the farmer is finally compelled to grow soil enriching crops or to apply home produced or artificial fertilizers. Such

HARVESTING SUNFLOWER SILAGE

Growing from nine to twelve feet tall, as much as thirty tons of green feed per acre. When put in the silo, it kept well and was readily eaten by cows and fattening steers during the winter. (Fig. 13.)

SUNFLOWER BLOOM OF HUGE SIZE FROM MONTANA

During the last three years experiments have been carried on at Bozeman, Mont:, which have shown that the sunflower fulfilled remarkably well the need for a forage crop which would yield a high tonnage and help control the weeds. (Fig. 14).

crops will also help to control the weeds but experience has taught us that we cannot master them completely without a bare fallow or summer-tilled crop. In many parts of the United States, corn, beans, potatoes or sugar beets furnish the cultivated crops that may be grown on a large enough scale to fit into a rotation system. We are, however, too far from market to grow potatoes in large areas, beans and corn are not adapted to our high altitudes. They are too uncertain and too small in yield to be grown to advantage.

Another problem was to find a forage crop that would yield a high tonnage under our conditions. In the lower valleys alfalfa is the large yielding forage crop and it does very well in most of the high valleys, as also does clover, but these alone would not control the weeds.

Some four years ago one of our extension men visited a farmer in the Flathead Valley in the Northwestern part of the State who was growing Russian Sunflowers, which were very large producers of forage. He suggested to our agronomist that he believed this plant had possibilities as a forage plant under Montana conditions. Acting on this suggestion in the summer of 1915 a small area, about 1/10 acre, was planted to sunflowers in our experimental field. The crop was planted in rows some 3 feet apart and grew immensely, producing over 30 tons of green feed per acre. The crop was cut and put into the silo, which was being filled with clover. It was put in when the silo was about half full so that there was clover both above and below the sunflowers. During the winter it was fed to our dairy cows which ate the sunflower silage as readily as they did the clover silage and seemed to do just as well upon it.

The next season (1916) we planted 3 acres of the sunflowers, planting in rows about 30 inches apart. The crop was

LOADING GREEN FEED INTO SILOS

Sunflowers make an equally satisfactory forage for cattle whether fed as a soilage crop or as ensilage. It has the drawback of having to be run through an ensilage cutter before it can be used to advantage, but makes a very good winter feed when cut. (Fig. 15).

not irrigated, though some sub-irrigation water was available from seepage. The crop grew well, stood 9 to 10 feet tall and yielded about 22 tons of green feed per acre. We started to feed the sunflowers to the cows the latter part of August. They were run through an ensilage cutter and fed green from the field. The cows ate the forage readily. For comparison we divided the cows into two lots and fed green corn to one of the lots. The cows on the sunflowers ate this forage just as readily as those getting corn and maintained their milk flow just as well. This test was continued for some three weeks. The sunflowers remaining were put into the silo and fed during the winter to both cows and fattening steers. Samples were taken of the green forage for chemical analysis but the destruction of our chemical laboratory last fall destroyed these and prevented the chemical studies contemplated. The results of the feeding test were very satisfactory, however.

Some fear was expressed that the sunflowers would taint the milk, so the milk from the cows getting the sunflowers was kept separate from that produced by the cows getting the regular feeds. One could not find any difference in flavor as a result of the feeding of the sunflowers. In other words, one guessed wrong as often as he guessed right in picking out the milk of the cows fed the sunflowers.

The past season we planted 7 acres to the sunflowers. Again the crop did well, growing 11 or 12 feet high and yielding close to 25 tons of green forage per acre. We repeated the feeding comparison with the green corn as a food and with equally as good results as the year before. We have this year filled a 125-ton silo nearly full of sunflowers and have planned this winter to repeat the test of last year. We have also taken samples for chemical analysis.

Two facts, I believe, we have demonstrated: first, that the Russian sunflowers make a satisfactory forage for cattle, whether fed as a soiling crop or as

ensilage. Next, it is our largest yielding forage crop, producing fully two and one-half times as much forage as will corn in our high valleys, and more than twice as much as clover for the season. It is, moreover, a crop that can be cultivated and later so thoroughly shades the ground that weeds get a very poor chance to grow. It has one drawback in that it must be run through an ensilage cutter before it can be used to advantage as forage for cattle, and can only be cured in the silo for winter use.

We have yet many points to study as to the best method of growing the crop and with what other forage it is going to combine to give the best results. We are also trying out the crop on the dry lands in various parts of the state, to determine its value, under those conditions. We are not as yet urging farmers to grow the crop largely but merely asking them to try a small area to find out how it yields, and those who have ensilage cutters can also try it as a forage for cattle. It is worthy of a trial by other experiment stations which are located as we are in a high mountain valley.

Factors Affecting Egg Production

After a long experimental study of the factors affecting egg production, E. D. Ball and Byron Adler[1] have made the following interesting conclusions. Environmental factors influence the records of pullets more than those of mature hens. The curve of distribution in a low record flock is practically parallel with that of a high record flock. This was also true of individual hens.

The production of general purpose breeds was compared with that of Leghorns. General purpose breeds reached their maximum early in the season and rapidly fell to moderate production, while Leghorns reached their maximum a month later, but continued to produce heavily for several months.

Winter egg production is more variable than annual production and seems to be closely correlated with environmental factors. Flocks that made low records the first winter made high ones the second and *vice versa*. Those with low first winter records made higher three-year records than high first-year flocks. The correlation between first winter production and that of later years was only 25%.

The higher the production of an individual, the great percentage will be made in winter, regardless of age. There does not seem to be any foundation for the assumption of a division of the laying period into units. The date of hatching, when kept between March and May, did not appear to influence total production. The time between hatching and laying affected total production, the latest maturing pullets being the poorest producers. The date of laying the first egg was not important except as indicating the length of time to maturity.

New Paper-making Materials

The Imperial Institute of India has recently reported in *Commerce Reports* the success of its experiments with three new paper-making plants that may be of use in developing new fibers. *Ecdeiocolea monostachya*, a rushlike plant belonging to the order Restiaceae found only in Australia, furnishes stems from two to five feet in length which yield 44% pulp, and a slightly darker paper than that of Algerian esparto grass. An African tree, *Neoboutonia macrocalyx*, which attains a height of fifty to sixty feet, was also tested, and a pulp was produced from its timber which bleached easily, giving an opaque and almost white paper which did not shrink on drying. Brachystegia bark (Brachystegia Randii) was also prepared, the pulp when unbleached, giving a strong, dark brown paper, or when bleached, a white paper of good quality. Because of unfavorable local conditions in Rhodesia, the home of the tree, however, it is improbable that this last could be of commercial promise at present.

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[1] E. D. Ball and Byron D. Adler; *Factors Affecting Egg Production*, II.

COLOR INHERITANCE IN MAMMALS

X., The Cat—Curious Association of Deafness with Blue-eyed White Color and of Femaleness with Tortoise-shelled Color, Long Known—Variations of Tiger Pattern Present Interesting Features.

SEWALL WRIGHT

Bureau of Animal Industry, Washington, D. C.

Tabby cat with tiger-pattern vSIAEXb

$1a_1$	——	
$1a_2$	V,v	V—white (normal or blue eyes)
	S,s	s—piebald (unit factor uncertain)
$1a_3$	I,i	i—dilute tabby (maltese and cream)
1b	——	imperfect albinism of Siamese cat?
$2a_1$	A,a	a—black
$2a_2$	E,e	Ee—tortoiseshell female ee or e- —orange (male or female)
$2a_3$	——	
2b	——	
3	Xa, Xb, Xc,	Xa—finely lined or uniform tabby Xe—wide striped or blotched tabby

Classification explained in paper on the mouse, JOURNAL OF HEREDITY, 8:373 August, 1917.

TWO remarkable peculiarities, associated with color in cats, have been known for a long time. Darwin[1] mentions the fact that blue-eyed white cats are generally deaf, and also that tortoiseshells are nearly always female.

Investigations on the blue-eyed white cats have been made by Przibram[2] and by Whiting.[3] The latter has not yet published his results, but has very kindly permitted some mention of them here. Wholly white cats may have the yellow eyes of ordinary colored cats, or they may have blue eyes, or one eye may be yellow and one blue. Whiting finds that solid white, whatever the color of the eyes, is due to a unit dominant factor. Przibram crossed together white cats with various eye-colors. The data are not extensive enough to base final conclusions on them, but there seems to be inheritance of the eye color. There was some indication that asymmetry ran in families, but not a specific kind of asymmetry. The variations in eye-color can best be looked upon as analagous to the variations in extent and symmetry of the white pattern in the coat of any piebald mammal. Asymmetry in such patterns has never been demonstrated to have a heredity basis. A tendency for asymmetrical eyes to run in families in cats could be explained as due to heredity of a general level in amount of color, independent of the main factor for solid white. Some families are at such a high level that the white pattern seldom invades the eyes, which therefore remain yellow. Others are at so low a level that all individuals are blue-eyed. In families at an intermediate level, it is largely chance whether or not an eye is invaded by the white, and asymmetry is common. When the pattern is sufficiently extensive to invade the eyes, it is easy to understand that it might also invade the inner ear, but why this should cause deafness is not so clear. The allied case of deafness in wall-eyed white dogs has been noted in the previous paper. The preceding discussion interprets the solid white condition as an extreme form of a piebald pattern, and not at all comparable with albinism.

White patterns, resembling the usual piebald patterns of other mammals, are very common in cats. No doubt the factor or factors, which are responsible, are independent of the other color-factors, as spots of all colors can appear on a white ground. The mode of inheritance does not seem to have been worked out.

DILUTE COLORS IN CATS

The dilute color of the maltese cat, as compared with the black variety, has been demonstrated to be due to a simple recessive factor by Doncaster.[4]

The same factor reduces orange to cream, and the ordinary black-and-orange tortoiseshell to a maltese-and-cream tortoiseshell. The effects are very similar to those produced by the dilution factors of mice and rabbits and the factor thus fits in well with class $1a_3$.

A very different kind of dilution is present in the Siamese cats. These are born white but become a sort of fawn color with dark chocolate on the ears and feet. The eyes are deficient in pigment and appear blue. Bateson[5] noted the similarity to the Himalayan rabbit. The mode of inheritance is not known, but the appearance strongly suggests that the variation is homologous with imperfect albinism as found in rats, rabbits, guinea-pigs, and dogs and belongs in class 1b. If this is true, blue-eyed Siamese and the ordinary blue-eyed white variety are variations of very different kinds. The first is near the extreme in a dilution or albino series; the second, the extreme in a piebald series.

TORTOISESHELL AND ORANGE

The first attempt to explain the curious correlation between tortoiseshell color and female sex in cats was made by Doncaster,[6] who suggested that there is a difference in dominance, in the sexes, in the opposed pair of characters, orange and black. Thus he supposed that orange is completely dominant over black in males, but imperfectly dominant in females, which, therefore show a patchwork of orange and black. Little[7] made crosses which led him to advance the hypothesis that the orange factor is linked with the sex-determining factor in heredity, a mode of inheritance which had been discovered, in the mean time, by Doncaster in the moth Abraxas. He assumed that females are homozygous for the sex-determining factor, males heterozygous. Thus females may be of any of the three types, EE, Ee, or ee, black, tortoiseshell, and orange respectively, while males can only be of the types, E- or e-, black and orange. This hypothesis was also adopted by Doncaster[8] in his next paper as explaining the main facts, but he noted the existence of rather frequent discrepancies between expectation and observation. The following table gives the results which he obtained from breeders. Tabby and maltese are included with black, the various kinds of tortoiseshells are combined, and some cases called doubtful are omitted. The discrepancies are in italics.

	Females			*Males*		
	Black	*Tort.*	*Orange*	*Black*	*Tort.*	*Orange*
Black ♀ × Orange ♂	*13*	51	..	51	*1*	..
Tortoise ♀ × Black ♂	14	22	..	32	*1*	37
Tortoise ♀ × Orange ♂	*6*	45	53	45	*1*	58
Orange ♀ × Black ♂	..	16	..	..	.	20
Orange ♀ × Orange ♂	..	*3*	40	..	.	48

22 discrepancies among 263 females.
3 discrepancies among 294 males.

Doncaster advanced several hypotheses to explain the discrepancies, *e. g.*, imperfect sex-linkage, difficulty in distinguishing dilute tortoise from maltese, and, later, non-disjunction. Whiting[9] found it possible to produce all grades of tortoise from nearly self orange to nearly self black, and suggested that occasional overstepping of the limits between the colors, due to coöperation of independent minor factors for extension or restriction of black, would account for the aberrant kittens. Ibsen[10] advanced an hypotheses involving a high degree of linkage between a factor for tortoise as opposed to yellow and a factor for black as opposed to yellow, but was obliged to fall back on Whiting's explanation in some of the cases.

DATA FOR FEMALES LESS RELIABLE

The writer is inclined to accept Whiting's explanation in the main. There is, however, a difficulty with all attempts at explaining the discrepancies which should be pointed out. In Doncaster's data there are many

more discrepancies among females than among males. He finds 22 exceptions among 263 female kittens, or 8.4%, but only 3 among 294 males, or 1.0%. A color which depends on a sex-linked factor is inherited by males wholly from their mothers. Thus black females (EE) should have only black sons (E-), yellow females (ee) only yellow sons (e-), and tortoiseshell females (Ee) both blacks (E-) and yellows (e-) in equal numbers, regardless of the colors of the sires. The data fit the theory admirably among the 294 males except for the occurance of 3 tortoiseshells. Cutler and Doncaster[11] have recently presented evidence indicating that tortoiseshell males are generally sterile. This makes it probable that something more is involved than the action of subsidiary extension factors, and the authors suggest that there may be a connection between the sterility and the possession of a color normally belonging to the female. Putting this suggestion in a definite form, it may be taken to mean that the rare tortoiseshell males may be cats with the two X chromosomes of females, but in which some other cause has overbalanced the sex-determining tendency of the X chromosomes, and produced males or near males. Such an interpretation would fit well with the results of Whitman and Riddle[12] in sex control in pigeons, and with Goldschmidts[13] work on sex-intergrades in Gypsy moths.

The absence of other discrepancies among the males shows that very few if any of their mothers could have differed in color from that expected on their genetic constitution. But these same mothers produced 8.4% aberrant daughters which in the next generation would be expected to produce many aberrant sons. More experiments under laboratory conditions are needed. Almost any records should give reliable results for males since there should never be any question about the identity of the mother of a kitten, but for females, the sire must be known as certainly as the dam and certainty as to the sire is notoriously difficult to establish in cats.

The effects of the factor, which change black to tortoise or orange, place it on the whole in class $2a_2$, with the factors for tortoise and self yellow in guinea-pigs. As has been noted before, however, the distinction between classes $2a_2$ and $2a_3$, *i.e.*, factors which determine a patchwork of black and yellow and those which determine a uniform change in the density of black, is not very sharp. In a few tortoise-shell kittens, which the writer has observed, the black parts of the coat have a brownish hue and appear much less intense than the black of solid black kittens of the same litters. This indicates that, in cats of formula of Ee, there is a general reduction in density of black which easily passes into complete elimination in irregular spots in the coat. This leads to comparison with the sooty yellow or tortoiseshell rabbits which have even more claim to be put in class $2a_3$.

THE PATTERN OF TABBY CATS

The common tabby cat has a very complex pattern with an obvious relationship to the color patterns of wild Felidae, and these are of a general type which is very common among other wild mammals. Several kinds of variations are found in domestic cats and a study of these is of great interest for the light it throws on the colors of mammals in nature. In the common tabbies with the tiger pattern, there are alternate dark and light stripes running perpendicularly down the sides of the body, longitudinally along the back and head, and around the legs and tail. The dark stripes are usually of hair which is wholly black while each hair in the light stripes is black with a cream colored band near the tip, thus resembling the hair of agouti-colored rodents. The colors on the back are more intense than those on the belly. The variations in the tabby pattern have been studied in much detail by Dr. Whiting to whom the writer is indebted for permission to use genetic results on which the following discussion is based.

The two elements in the tabby pattern, *i.e.*, the striping of the coat as a whole, and the banding of individual hairs, vary wholly independently of

each other. With the same pattern of stripes, the banding may vary from very wide, giving the cat a nearly yellow appearance, to very narrow. Indeed in solid black cats, in which the banding is wholly eliminated, the pattern of stripes can often be made out, especially in kittens, in a so-called ghost pattern. Darwin[14] mentions this point. According to Pocock,[15] the ghost pattern is due to a difference in glossiness in stripes representing those of tabbies.

In cats, with given widths of banding the character of the stripes may vary very greatly. There are three distinct types according to Whiting. In the so-called blotched tabby the stripes are very wide, few in number, and much broken up. The common tiger pattern has been described above. There is also an almost uniform tabby in which the stripes have become so narrow that they lose their distinctness for the most part. Ghost patterns of all of these types may be seen in different black kittens.

CLASSIFICATION OF VARIATIONS

The possibility of combining any grade of banding with any kind of striping indicates that independent kinds of factors are involved. Before considering the mode of inheritance, we may attempt to classify the factors involved. For this purpose a comparison of an ordinary black-and-yellow tortoise shell with a tabby-and-yellow tortoiseshell is very instructive. The black and the tabby spots differ just as do solid black and solid tabby coats. The yellow areas in the two coats, on the other hand, will be found indistinguishable. This, however, is not because the pattern is lost. The yellow of the black-and-yellow tortoiseshell, as well as of the tabby-and-yellow kind, shows distinct alternate stripes of orange and cream. In the tabby tortoise, the dark stripes of the tabby areas continue as orange stripes in the yellow part of the coat while the light, banded stripes of the tabby continue as cream in the yellow part.

The fact that there is no visible difference between the black and the tabby tortoiseshells in the yellow parts of the fur shows that the banding factor, by which alone these varieties differ, does not act on color in general, but merely on black. We may describe its action by saying that it has no effect on enzyme I, but inhibits enzyme II during part of the development of the hair. Doncaster[16] showed that tabby is dominant over black and differs by only one factor. Thus banding in cats appears to be in every way comparable with the banding of agouti-colored rodents and the dominant factor may be put at once in class $2a_1$. The variations in the width of the bands may be due either to multiple allelomorphs of this factor as in cases discussed in the papers on mice, rabbits, and guinea-pigs, or they may be due to subsidiary factors, which vary the density of the black, which the banding factor must inhibit; and similar to those noted in guinea-pigs.

The case is very different with the stripes. The contrast in intensity of the orange and cream stripes shows that these differ in the activity of the fundamental color-producing enzyme, enzyme I. As there is little or no effect on the intensity of black, the difference in intensity is more like that due to factors of class 1b than of class $1a_3$. Greater activity of enzyme I, in the intense stripes, does not, however, account satisfactorily for the reduction or elimination of the bands in the latter, in tabby cats. To take a parallel case, reduction of the black-and-red agouti variety of guinea-pig to the sepia-and-cream agouti variety by a factor of class 1b, has no appreciable effect on the width of the red or cream band. It is necessary to suppose that the dark stripes have a greater activity of enzyme II, as well as of enzyme I, and that this tends to neutralize the inhibiting action of the banding factor. It will be seen that this interpretation is identical with that reached in the case of the agouti patterns of rodents, if the whole back of the mouse, rat, rabbit, or guinea-pig is compared to a dark stripe of the cat, while the belly of the rodent is compared to a light stripe. It should be added, however, that there is also a difference between the back and belly of cats, probably comparable to the

situation in rodents, but of lesser importance than the difference between the stripes.

FACTORS OF REGIONAL DIFFERENTIATION

In cats, there is a feature which finds no parallel in the rodents mentioned above. In the latter cases, the difference between back and belly in the activities of enzymes I and II, was supposed to hold for all individuals and to be merely revealed more or less clearly in the different color varieties. In cats, we have actual variations in the localization of the patterns. According to Whiting, the three types of tabby, finely lined, striped, and blotched, segregate sharply in crosses and are probably inherited as a series of three allelomorphs in which the highest dominant is the lined pattern, while the blotched pattern is the lowest recessive. Although the stripes differ in the activity of both enzymes I and II we cannot compare this series of factors with the combined factors of classes 1b and $2a_3$. They do not determine an ascending or descending sequence in activity of enzymes I and II, but instead a sequence of types of regional differentiation. Both the dark and light stripes are wide in the blotched tabby, relatively narrow in the tiger tabby, and reduced to mere lines in the lined tabby. The fact that variations of both classes 1 and 2 are involved suggests that the dark strips come to differ from the light ones at some critical period in development by a general metabolic difference which effects the activities of both enzymes, rather than by a specific chemical difference. This was the view adopted to account for the difference between back and belly in the rodents and the differences between males and females in tricolor guinea-pigs. On this view, the Mendelian factors for the different types of striping determine short, medium, or long waves during the development of the epidermis in some general metabolic condition at the critical period in development for determination of color.

No other unit Mendelion factors have been noted in mammals which determine a type of regional differentiation but the existence of hereditary factors of this kind was noted in piebald guinea pigs and in cattle. In the latter especially, the different types of pattern which have become fixed in the white-faced Herefords, the white-belted Dutch cattle and the irregular Holsteins, with a given quantitative grade of piebald, is especially noteworthy. Such factors, which determine a type of regional differentiation, must be put in a new class.

TABLE OF FACTOR COMBINATIONS

	EE(♀) or E–(♂)	Ee(♀)	ee(♀) or e–(♂)	Pattern
vSIAXa	Tabby.....	Tabby-yellow tortoise	Yellow.....	lined or uniform.
AXb	Tabby.....	Tabby-yellow tortoise	Yellow.....	Striped = tiger pattern
AXc	Tabby.....	Tabby-yellow tortoise	Yellow.....	Blotched. (Black vs. cream agouti in tabby areas; orange vs. cream in yellow areas.)
aXa	Black.....	Black-yellow tortoise	Yellow.....	Lined or uniform.
aXb	Black.....	Black-yellow tortoise	Yellow.....	Striped-tiger pattern.
aXc	Black.....	Black-yellow tortoise	Yellow.....	Blotched. (Ghost pattern if any, in black areas; orange vs. cream in yellow areas.)

V—converts any color into solid white with or without reduction of eyes to blue.
s—adds piebald white pattern to any color variety.
i—reduces all black in above patterns to maltese, all orange to cream and cream nearly or quite to white.

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French Stocks in Canada

In the November issue of the JOURNAL OF HEREDITY, I find a lengthy quotation from the work recently published by the Scribner's, at New York: *Mankind—Racial Values and Racial Prospects*, by Seth K. Humphrey, "a Boston business man and author, but a serious student of biology."

Speaking of Canada, Mr. Humphrey has written the following:

"The cloud on her racial horizon is her legacy of original French stocks, which persist in remaining at a genetic and cultural level below that of the dominant English-speaking population. They may fill a worthy place in Canada's economic scheme, but they do not furnish their proportion to the essential ability of Canada's people, and to that extent are a hindrance to her racial future."

Mr. Humphrey seems to ignore that:

As regards the "genetic level," the French Canadians—who, up to the latest period, have doubled their numbers every twenty-five or thirty years (a phenomenon almost unique in history)—are the descendants of perhaps the best choice of colonists that ever peopled a colony. As may easily be ascertained from history, it was not left to any one indiscriminately to come to New France. The authorities, on the contrary, were careful to favor the introduction of none but persons most commendable by their moral and their religious spirit, and who, as a fact, originated from the best provinces of France. It is no less remarkable that, either owing to the fact that there always existed in the colony a considerable proportion of highly cultivated ecclesiastics, functionaries and military officers, or because a great many of the settlers came from the region of Paris, the pure French idiom, and not any of the *patois* then spoken, and spoken even at the present day, in different parts of France, was established and maintained in New France, now the Province of Quebec.

As for the "cultural level," the French Canadians possess two great French Universities, and twenty classical colleges, where the Greek, Latin, English and French language and literature are thoroughly taught. In the average attendance of pupils in schools of every nature and grade, the French Province of Quebec, during the period 1901–1915, has surpassed, in a notable degree, that of all the other provinces of Canada. In the intellectual field, there is hardly any section, literary, scientific or artistic, in which, alongside the greatest name of the English race in Canada, the French Canadians are not able to place one of their own who can equal and sometimes surpass his competitor.

Many times have statesmen and writers in England congratulated Canada for the "French stocks" she owns, and the important services accruing therefrom, far from being "a hindrance to her racial future."

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Editor of—"Le Naturaliste Canadien."